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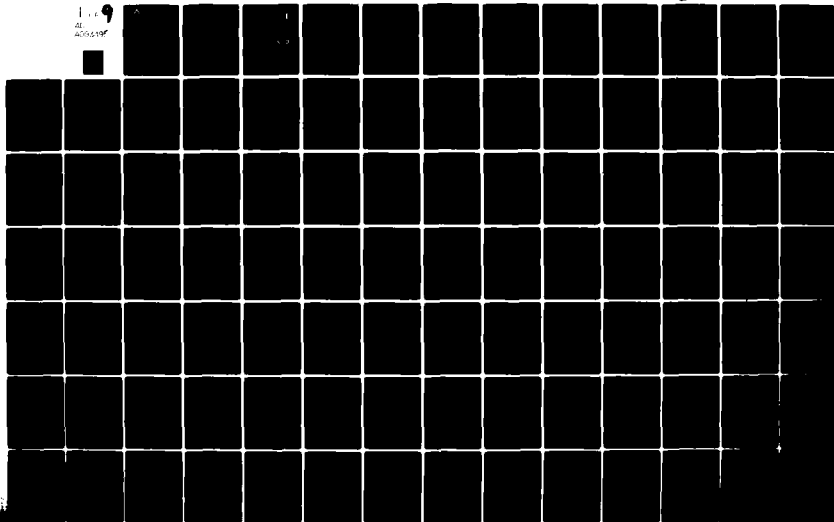
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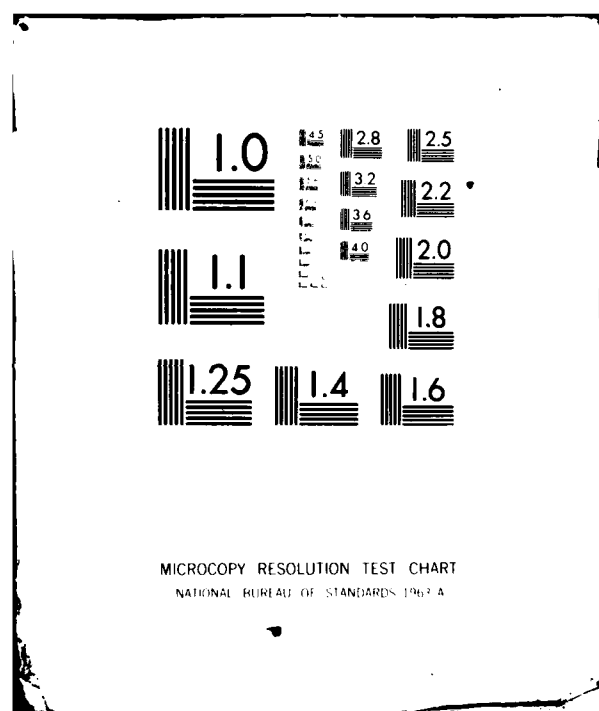
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REVIEW OF  
SPECIFICATIONS FOR ZINC-RICH PAINTS

by  
Fred Ordway and Mark J. Hammell

September 1979

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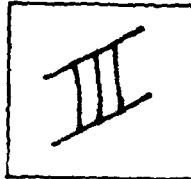
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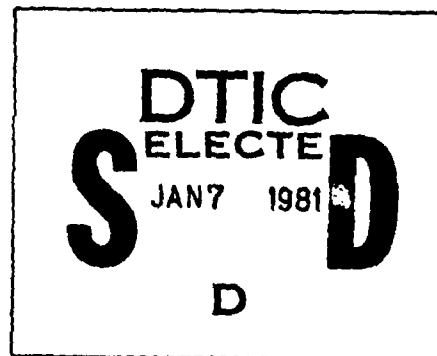
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## ABSTRACT

Specifications on zinc-rich paints that are now in use or proposed have been collected from governmental agencies, industry associations, and manufacturers. A tabulated comparison of 48 specifications, which were received in time for compilation, is presented. Complete copies of all those received, 78 in number, are appended.

The choice of requirements for a new specification depends upon the selection of the formula, performance, and/or qualified product approaches. Statements of requirements in current specifications are adequate to cover all aspects except the characterization of the basic electrochemical protective function peculiar to the zinc-rich paints. Development of suitable electrical/electrochemical test specifications is recommended.

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## SECTION 1

### INTRODUCTION

This work was performed under the technical management of Mr. Stephen D. Rodgers of the David W. Taylor Naval Ship Research and Development Center, Annapolis.

#### 1.1 Objective

The object of the project was to assemble, insofar as possible, a complete collection of specifications, in use or proposed, applying to zinc-rich primers and paints; to tabulate the provisions of the various specifications for comparison; and to discuss the content of the various specifications in general with respect to Navy requirements.

#### 1.2 Sources

Information was obtained from the following sources:

##### NATIONAL GOVERNMENT AGENCIES

Messrs. S. D. Rodgers and R. F. Supcoe,  
DTNSRDC/Annapolis  
Federal Highway Administration  
Defense Documentation Center  
National Academy of Science, Transportation  
Research Board  
NASA/Kennedy Space Center  
NASA/Technology Utilization Office  
Canadian Government Specifications Board

##### STATE HIGHWAY AGENCIES

American Association of State Highway and  
Transportation Officials (AASHTO)  
Arkansas State Highway and Transportation Board  
California Department of Transportation  
Connecticut Department of Transportation  
Florida Department of Transportation  
Hawaii Department of Transportation  
Indiana State Highway Commission  
Iowa Department of Transportation  
Kansas Department of Transportation  
Maryland Department of Transportation  
Minnesota Department of Transportation  
Mississippi State Highway Department  
Missouri State Highway Commission  
Nebraska Department of Roads

New Hampshire Department of Public Works  
and Highways  
North Carolina Department of Transportation  
North Dakota State Highway Department  
Ohio Department of Transportation  
Oklahoma State Highway Commission  
Rhode Island Department of Transportation  
South Carolina Department of Highways and Public  
Transportation  
Tennessee Department of Transportation  
Texas State Department of Highways and Public  
Transportation  
Vermont Agency of Transportation  
Utah Department of Transportation  
Wisconsin Department of Transportation

#### INDUSTRY TECHNICAL ASSOCIATIONS

Federation of Societies for Coating Technology  
International Lead Zinc Research Organization  
National Association of Corrosion Engineers  
National Paint and Coatings Association  
Steel Structures Painting Council  
Water Pollution Control Federation  
Zinc Institute

#### MANUFACTURERS

Ameron  
Carboline Company  
Mobil Chemical Co.  
New Jersey Zinc Co.  
Porter Paint Co.  
St. Joe Zinc Co.

## SECTION 2

### PROCEDURES AND RESULTS

Most of the sources listed, other than the state highway agencies, were contacted by telephone or in person. A form letter requesting the information was sent to the chief materials engineer or other appropriate official of each state, as listed in the Operating Subcommittee on Materials of AASHTO in their "Special Product Evaluation List, December 1977". Replies to these letters continued to arrive beyond the date when the tabulation for appendix sections A-E had to be closed, but all that reached us before final typing of this report have been included in appendix section H.

The contents of each specification were tabulated, conceptually, in a single column--actually, in five columns on separate pages in order to provide space for all the significant items required in the tabulation. The subdivisions of the tabulation are:

- A. Description and composition of the paint;
- B. Ingredients, their descriptions, and their specifications;
- C. Tests required; specifications for the test procedures;
- D. Requirements regarding test results, performance, and qualification;
- E. Packing, packaging, and marking requirements.

The columns were arranged two on a page, each specification being assigned a column number that identifies each of its five subdivisions. To facilitate comparison between specifications as to a particular item of the tabulation, the pages for a single subdivision were grouped together. Thus the inter-comparisons are always within one of the small sections A-E, which form the first five sections of the appendix.

The appendix sections A-E can in principle be assembled to form a single large table comparing all the specifications by setting the pages of section A in a horizontal row (A-1, A-2, . . .), those of section B in a second row just below the



corresponding pages of A, and those of C-E following in successive rows.

In tabulating the information from the specifications, the convention was adopted that entries are made only for items present in the specification, and no comments are made regarding items omitted. In several of the sections, the variety of items over all columns is so great that it would be impossible to devote a separate line entry to each of them; the tabulation would be several times as long and most of the entries would be blanks. Therefore the row labels on each page are often rather general, requiring more specific descriptions of the items of information in the individual columns. This should not hinder comparisons because a specific requirement, such as Fineness of Grind or Viscosity, always can be found within a space of two or three inches in any column where it appears.

A computer search was made by the Defense Documentation Center for the subject "Zinc-Rich Paints", and yielded a few references of possible interest, but none of these appeared to contain specifications and therefore the corresponding original reports were not procured. The references are given in appendix section F.

The tabulation contains two specifications from MIL-P-19453A, in columns 4 and 5, and one from California, in column 18, which do not involve metallic zinc. These were included because the zinc content is high and therefore the specification requirements are relevant.

The specifications themselves are reproduced, with letter of transmittal if any, in sections G-J of the appendix. These follow the same order of precedence as was used in the tabulated columns in sections A-E:

National government specifications

DOD  
MIL  
FED  
Other U.S. Government agencies  
Other nations

State government specifications  
Industrial/technical association specifications  
Manufacturers' specifications.

### SECTION 3

#### DISCUSSION

When a consumer contemplates purchasing a product in quantities large enough to justify establishing his own complete specification for the product, his strategy in formulating the specification must depend on his view of the technological development embodied in the product. Procurement of a new type of product may have to be based on a composition specification, while a mature technology providing well established products may require only specification of performance characteristics.

If the technology is in flux, new developments may yield new competitive products with superior performance/cost ratios. The specification should define the required performance rigorously, but leave the composition and method of making the product open for maximum exercise of the vendors' ingenuity.

The specifier's strategy depends also on the availability of adequate performance data on the products of enough independent producers for competitive procurement; the time constraints on procurement relative to the time required to develop performance data; and the criticality of the application. A specification for zinc-rich paint may thus be written broadly on performance, for general application where cost is important, or narrowly on a specific formula when the use is extremely critical. Even in the latter case the specification generally will include performance factors such as fineness of grind and viscosity, related to application characteristics, and storage stability testing as a measure of shelf life. The following discussion of various provisions of the specifications surveyed will assume that either performance or composition specifications, or a combination, may be required.

#### Composition

Information for the specification of composition is well provided by the body of DOD, MIL, FED, and ASTM specifications. Current specifications, when they define composition, appear to be quite satisfactory.

A distinction should be made between defining composition in a formula, which the vendor is expected to follow in his plant, and specifying analyses to verify the composition. The former approach is at best unwieldy and difficult to enforce. When it is used in current specifications, it is apparently intended more as advice to the vendor than an enforceable stipulation; otherwise the specifications using such formulas would provide for limits of error in the formula proportions and procedures for inspection or certification of the compounding operation. With the specification of a formula, at least some analytical data are usually required also for verification. From the Government's viewpoint, it is most desirable to specify only matters that can be determined by inspection of the finished product as delivered by the vendor, who may or may not be the original manufacturer. Whenever possible, composition should be defined entirely by analysis.

When a complete composition specification is used, it is necessary for the buyer to choose among the various types of zinc-rich paints (completely inorganic; organic silicate; organic) and several different specifications must be prepared to cover the field.

#### Application Properties

Current specifications provide very well for definition of the properties of paints in their application to the intended substrates. A full suite of standard requirements is available, including

- Particle Size of Powder (if packed separately)
- Condition in Can
- Consistency
- Fineness of Grind
- Compatibility with Thinner
- Spraying Properties
- Film Characteristics
- Surface Appearance
- Drying Time
- Adhesion
- Storage Stability
- Color
- Gloss.

The choice of requirements depends upon the intended application. Color and gloss might be specified, for example, in the case of a single coat finish but not for a paint intended as a primer with another paint as the top coat.

### Performance Properties

Performance appears to be reasonably well evaluated by standard tests, although some "accelerated" aging procedures may require six months or more of elapsed time for completion. Applicable requirements may include

- Stability of Color and Gloss
- Abrasion Resistance
- Salt Spray Corrosion Resistance
- Salt Fog Corrosion Resistance
- Accelerated Weathering Resistance
- Outdoor Exposure Resistance.

The most important characteristic to be specified is the service life. As a practical matter, this can be evaluated only by accelerated aging. The accelerated life test to be used may be dictated by the expected environment in real service. For marine service, a test involving exposure to salt, water, air, and possibly also simulated sunshine, would be appropriate. This is presumably the Navy's major concern. For service in contact with ground water, acid rain, building materials, chemicals, or industrial wastes, however, the simple marine weather test might be inadequate. Exposure to salt, acid, and alkali represent three significantly different types of deterioration as they affect the zinc, and possibly also as they affect the binder. The selection of an accelerated life test must take such differences into account.

### Safety Properties

Various requirements may be imposed by considerations of health and safety, including

- Odor
- Compliance with Air Pollution Regulations
- Flash Point
- Toxic Metal Content.

### Packaging

Appropriate specifications regarding packing, packaging, and marking are routinely included in paint specifications.

### Qualification

Whether to use a Qualified Products List is an administrative decision involving procurement policy and procedures as well as the state of the technology and of the market in the product. The QPL can be useful only after a reasonable

number of producers has entered the market and qualified for listing. This implies a reasonably mature technology with several practitioners who have been active for a period of the order of years. When the product is still developing, or it is necessary to encourage new producers, the QPL procedure can be used only in combination with a specification based on objectively measurable properties. QPL acceptance can be based on demonstrated life in actual service, which is perhaps the safest measure of acceptability available to a buyer.

#### New Considerations

The protective effect of a zinc-rich coating is primarily electrochemical, like that of a pure zinc electroplate or hot-dip galvanize. The zinc-rich coating may be more economical, both because it is more easily applied and because it contains less zinc, and more protective because the binder in the coating may protect the zinc from excessively rapid attack by the environment. The binder must, of course, leave a sufficiently exposed zinc surface to provide the current flow that maintains the protective cathodic potential.

In view of the importance of the cathodic protection afforded by the zinc coating, the conductivity of the coating is clearly an important characteristic. High conductivity is encouraged by an extremely high loading of zinc in the film, which is usually required by specifications; but this may detract from other desirable film properties such as strength, adhesion, or impermeability.

The service life is affected by the zinc content if its dissolving or oxidation is the controlling mechanism of degradation of the coating.

Service life may also be considerably affected by synergistic effects of other constituents of the film and the effects of other degradation mechanisms.

High zinc content is an important cost factor. An ideal specification might well require a stated minimum zinc content, but the minimum should not be so high as to preclude more economical and efficient formulations requiring less zinc for equivalent service. It is clear that further development of this technology will include exploration of

formulas in which zinc content is minimized while the balance of electrochemical potential, conductivity, and service life is maintained. Additives other than metallic zinc may be employed to maintain required conductivity at lower zinc content. For procurement of a satisfactory product at minimum cost, it is desirable to specify only those properties that show satisfactory performance of the basic functions of the product.

It is worth considering, therefore, whether the protective function of the coating should not be directly measured in determining whether a given zinc-rich paint is acceptable for a proposed application.

The crucial electrochemical protective function of the zinc-rich coating may be most suitably measured by electrochemical techniques. For example, the potential of the zinc surface relative to a bare steel counterelectrode can be measured as a function of current flow in a solution simulating expected surface environments. The results may be interpretable in terms of the protective capacity, i.e., the proportion of bare metal that can be protected in an incompletely coated area.

The conductivity may depend on other factors than the zinc content alone, and presumably can be most effectively assured by specifying a direct measurement. Whether the important parameter is the sheet conductivity or the volume conductivity across the film is unclear.

Measurement of the sheet conductivity requires a substrate whose own sheet conductivity is much higher than that of the film. An insulating substrate can be used if the character of the film is not affected by substituting it for the metal substrate on which the film would normally be used. Measurement of the transverse resistance of the film would be considerably more difficult because the expected resistance values are low. A commercial milliohm meter might be applicable, but the measurement of such low resistances must be done by the four-terminal technique, which may be difficult or impossible to apply in this case.

These electrical and electrochemical aspects of zinc-rich coatings should be examined with the objective of developing tests for the fundamentally significant properties of the zinc-rich paints that are not revealed by the present tests applied to coating materials whose function is not electrochemical. With this addition to his armament, the specifier

will be equipped to define requirements that assure a satisfactory product but allow maximum latitude for vendors to employ the most efficient (i.e., lowest-cost) formulations.

## SECTION A

### Description and Composition

This section contains requirements as to the percentages of stated ingredients. Compositions and other characteristics of the ingredients themselves are treated in section B.



## SECTION A

1

2

Specification	DOD-P-21035A (Navy)	MIL-P-23236 (Ships) Class III
Description	High zinc dust content primer for regalvanizing welds in galvanized steel.	Paint coating system for use on steel ship- board fuel or salt water tanks (silicone zinc type).
Composition		See "Provision Governing Qualification", Commanding Officer, Naval Supply Depot, Philidelphia, PA
Pigment	94% of total solids (min)	
Zinc	97.5% (min)	
Other		
Vehicle		See "Provision Governing Qualification", Commanding Officer Naval Supply Depot, Philadelphia, PA
Volatile		
Nonvolatile		
Other		

## SECTION A

3

4

## Specification

MIL-P-38336  
(USAF)MIL-P-19453A  
(Ships) Class I

## Description

A ready-to-mix, 2  
component self-curing  
inorganic zinc-rich  
primer for use on  
steel surfaces.Anticorrosive ship-  
bottom paint for use  
as an undercoat for  
antifouling paints,  
formula 14N-medium  
brown.

## Composition

## Pigment

42.5 - 44%

## Zinc

80% (min) of  
pigment

20% (min) of pigment

## Other

Venetian red	4.3%
Mica	6.4%
Diatomaceous silica	6.4%
Lead linoleate	0.43%

## Vehicle

56 - 57.5%

## Volatile

68% (max)

24% (max)

## Nonvolatile

32% (max)

32% (max)

## Other

Xylene	31%
Turpentine	9.7%
Alkali-refined linseed oil	5.0%
Tung oil	10.1%
Phenolic resin	16.1%
Cumarone-indene resin, hard	16.1%
Cumarone-indene resin, soft	11.1%

## SECTION A

5

6

Specification

MIL-P-19453A-  
(Ships) Class IIMIL-P-26915A  
Class A

Description

Anticorrosive ship-  
bottom paint for use  
on naval vessels as  
an undercoat for anti-  
fouling paints.  
Formula ND-dark  
brown.Ready-mix, single package  
zinc dust primer for  
use on steel surfaces.

Composition

Pigment

42.5 - 44%

Zinc

20% (min)

Other

Venetian red	4.3%
Mica	6.4%
Diatomaceous	
Silica	6.4%
Lead linoleate	0.43%
Lampblack	0.85%

Vehicle

56 - 57.5%  
24% (max)

68% (max)

Volatile

Nonvolatile

32% (min)

32% (min)

Other

Xylene	31%
Turpentine	9.7%
Alkali-refined	
linseed oil	5.0%
Tung oil	10.1%
Phenolic resin	16.1%
Cumarone-Indene	
resin, hard	16.1%
Cumarone-Indene	
resin, soft	11.1%

## SECTION A

7

8

## Specification

MIL-P-26915A  
Class B

MIL-P-15145B

## Description

Ready-to-mix, two-  
component zinc dust  
primer for use on  
steel surfaces.Corrosion-inhibiting  
coating for interiors  
or fresh (potable) water  
tanks.

## Composition

## Pigment

Zinc

70%

Total zinc

67.6%

Other

Zinc oxide

13.5%

Zinc dust

54.1%

Aluminum

stearate

1.3%

## Vehicle

Volatile

48% (max)

47 - 50.5%

Nonvolatile

32% (min)

17 - 20.5%

Other

Alkyl-phenol mixing  
varnish

13.2%

Paint thinner

17.3%

Cobalt naphthenate

drier

0.13%

Manganese naphthenate

drier

0.13%

# SECTION A

9

10

Specification	NASA/KSC F-0008 Type I, Class I	NASA/KSC F-0008 Type I, Class II
Description	Self-curing, zinc-rich coating used as a corrosion inhibitor. Inorganic zinc, organic solvent reducible.	Self-curing, zinc-rich coating used as a corrosion inhibitor. Inorganic zinc, water reducible.
Composition		
Pigment		
Zinc		
Other		
Vehicle		
Volatile		
Nonvolatile		
Other		

## SECTION A

11

12

## Specification

NASA/KSC F-0008  
Type II, Class INASA/KSC F-0008  
Type II, Class II

## Description

Self-curing, zinc-  
rich coating used  
as a corrosion  
inhibitor.  
Organic zinc, single  
component.Self-curing, zinc-  
rich coating used  
as a corrosion  
inhibitor.  
Organic zinc, two  
or more components.

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other

SECTION A	13	14
Specification	TT-P-641G Type I	TT-P-641G Type II
Description	Ready-to-mix or semiprepared primer for use on galvanized metal surfaces not in contact with foodstuffs or drinking water. Zinc dust, zinc oxide, linseed oil primer.	Ready-to-mix or semiprepared primer for use on galvanized metal surfaces not in contact with foodstuffs or drinking water. Zinc dust, zinc oxide, phthalic resin primer.
Composition		
Pigment	78 - 81%	62 - 65%
Zinc	98% (min) of pigment	98% (min) of pigment
Other		
Vehicle	19 - 22%	35 - 38%
Volatile	9 - 11%	57% (max)
Nonvolatile	89 - 91%	43% (min)
Other		

SECTION A

15

16

Specification

TT-P-641G  
Type III

AASHTO Proposed Revision  
Painting Metal Structure  
Sec. 14 (Inorganic)

Description

Ready-to-mix or semiprepared primer for use on galvanized metal surfaces not in contact with food-stuffs or drinking water. Zinc dust, zinc oxide, phenolic resin primer.

Two-component, self-curing ethyl silicate vehicle type zinc silicate paint.

Composition

Pigment

64-67%

50%

Zinc

98% (min) of pigment

98% (min) of pigment

Other

Vehicle

33 - 36%

50%

Volatile

50% (max)

75 - 77% of vehicle

Nonvolatile

50% (min)

23 - 25% of vehicle

Other

Ethyl silicate 27.7  
Polyvinylbutyral resin 5.5  
Secondary butyl alcohol 42.6  
Cyclohexanone 5.4  
1,1,2-Trichloroethane 5.5  
Dioctyl sodium sulfosuccinate 0.4  
Hydrochloric acid 2.2  
Normal propanol 4.2



## SECTION A

Specification	AASHTO Proposed Revision <u>Painting</u> <u>Metal Structures</u> , Sec. 14 (Organic)		California DOT 681-80-51	
Description	One-package, thermo-plastic organic zinc-rich primer for use on blast-cleaned steel structures in open air.		Ready-mixed fast drying zinc chromate paint for use on blast-cleaned steel surfaces coated with Pretreatment Wash Primer (681-80-52)	
Composition				
Pigment	62.3% (min)		46.9%	
Zinc	96.5% (min)		46.9%	
Other	Red iron oxide (max)	1.5%	Sienna	2.1%
	Thixotropes and additives (max)	3.5%	Magnesium silicate	4.3%
			Aluminum stearate	0.5%
Vehicle	37.7% (max)			
Volatile	28 - 32%			
Nonvolatile	72 - 78%			
Other	Polyaryl ether	19.0%	Alkyd resin	41.5%
	Ethylene glycol monoethyl ether acetate	66.8%	Thinner and driers	1.14%
	Toluene	14.2%		

## SECTION A

19

20

## Specification

California  
DOT 681-80-56California  
DOT 741-80-62

## Description

Two-component, self-curing zinc silicate paint.

One component thermo-plastic organic zinc-rich primer for use on blast-cleaned steel structures in open air, spray application.

## Composition

## Pigment

55 - 56%

62.3%

## Zinc

98%

96.5%

## Other

Pyrazolone red,  
dry 0.5%Red iron oxide 1.5%  
(max)  
Thixotropes and  
additives 3.5%  
(max)

## Vehicle

44 - 45%

37.7% (max)

## Volatile

## Nonvolatile

## Other

Hydrochloric acid 2.9%  
Ethyl silicate 27.7%  
Polyvinylbutyral resin 5.5%  
Secondary Butyl alcohol 47.1%  
Cyclohexanone 5.4%  
1,1,2-Trichloroethane: 5.5%  
2-Nitro-Propane 5.5%  
Dioctyl Sodium Sulfosuccinate: 0.4%Polyaryl ether 19%  
Ethylene glycol mono-ethyl ether acetate 6.68%  
Toluene 14%

SECTION A	21	22
Specification	California DOT 701-80-52	California DOT 8010-61J-36
Description	Wash primer for use on clean aluminum, galvanized surfaces, or on surfaces previously coated with organic or inorganic zinc-rich primers. Required for vinyl paint systems.	Zinc-rich organic vehicle primer for blast-cleaned structural steel.
Composition		
Pigment	9.5 - 10.5% (of resin)	63.2% (min)
Zinc	6.9% (min)	95% (min) of pigment
Other	Magnesium silicate: 1% Lampblack: 0.7%	Red iron oxide: 1.5% (max) Thixotropes and additives: 3.5%
Vehicle	72.3%	37.7% (max)
Volatile		
Nonvolatile		
Other	Butyl alcohol: 16% Polyvinyl butyral resin: 7% Ethyl alcohol: 48.8% Acid (curing) component: 20% Phosphoric acid: 3.5% Ethyl alcohol: 13.1%	Polyaryl ether: 19% Ethylene glycol monoethyl ether acetate: 66.8% Toluene: 14.2%

## SECTION A

23

24

Specification	North Carolina DOT 8.1558304 (Two- Component)	North Carolina DOT 8.1558304 (Single Component)
Description	Two-component, self- curing, partially hydrolyzed ethyl silicate vehicle type zinc silicate paint.	One package thermoplastic organic zinc-rich primer which dries by solvent release.
Composition		
Pigment		
Zinc	75% (of non- volatile)	80% (of nonvolatile)
Other		
Vehicle		
Volatile	63% (max)	32% (max)
Nonvolatile	37% (min)	68% (min)
Other	SiO <sub>2</sub> : 9% (min) of ethyl silicate	

## SECTION A

25

26

Specification	<u>Indiana DOT Painting</u> <u>Structural Steel,</u> <u>sec. V-A</u>	<u>Indiana DOT Painting</u> <u>Structural Steel,</u> <u>sec. V-B</u>
Description	Two-component, self-curing ethyl silicate type inorganic zinc-rich paint.	Single-package self-curing inorganic zinc silicate paint.
Composition		
Pigment		
Zinc	75% of total solids	75% of total solids
Other	96% of pigment	96% of pigment
Vehicle		
Volatile	55 - 61%	
Nonvolatile	39 - 45%	
Other	SiO <sub>2</sub> : 9 - 12% of ethyl silicate	SiO <sub>2</sub> : 9 - 12% of ethyl silicate

## SECTION A

27

28

## Specification

Iowa DOT 4182.02

Ohio Supplement 950

## Description

Two component or catalyzed single component self-curing ethyl silicate zinc-rich paint for spray application on blast-cleaned steel.

Two component or catalyzed single-component self-curing inorganic zinc silicate paint.

## Composition

## Pigment

Zinc

75% (min)

96% of pigment  
75% of total solids

Other

## Vehicle

Volatile

57 - 61%

Nonvolatile

39 - 43%

Other

SiO<sub>2</sub>: 9 - 12%

SECTION A

29

Specification

Ohio Supplement  
950 (Single Component)

Description

Acid catalyzed single  
component self-curing  
inorganic zinc silicate  
paint.

Composition

Pigment

Zinc

81% (min)

Other

Vehicle

Volatile

57 - 61%

Nonvolatile

39 - 43%

Other

SiO<sub>2</sub>: 9 - 12%

## SECTION A

30

31

Specification	Florida DOT 971.14
Description	Galvanizing compound for metalizing welded areas and repair of damaged galvanized areas.
Composition	
Pigment	80% (min)
Zinc	99% (min)
Other	Lead suboxide stabilizer: 0.15% (max)
Vehicle	20% (max)
Volatile	78% (max)
Nonvolatile	22% (min)
Other	Chlorinated rubber: 60%

Canadian Gov't.  
Specifications Board  
CGSB 1-GP 171c, Type I

Self-curing inorganic zinc coating for use on steel super structure decks and hulls of vessels, bridges, towers off-shore drilling rigs, tank linings, and reconditioned old equipment.



## SECTION A

32

33

## Specification

Canadian Gov't.  
Specifications Board  
CGSB 1-GP-171c  
Type II

Steel Structures  
Painting Council  
SSPC X 20X Type I

## Description

Self-curing inorganic  
zinc coating for use  
on steel super-  
structures, decks and  
hulls of vessels,  
bridges, towers, off-  
shore drilling rigs,  
tank linings, and  
reconditioned old  
equipment

Highly pigmented in-  
organic zinc-rich  
coatings capable of  
galvanically protecting  
exposed steel.

## Composition

## Pigment

Zinc

92% (min)

85% (min)

Other

87% (min)

## Vehicle

15% (max)

Volatile

Nonvolatile

Other

## SECTION A

34

35

## Specification

Steel Structures  
Painting Council  
SSPC X 20X Type II

Ameron Dimetecote E2

## Description

Highly pigmented in-  
organic zinc-rich  
coating capable of  
galvanically pro-  
tecting exposed  
steel.Single-component in-  
organic zinc-coating  
for use on structural  
steels in marine  
and land environments  
as a primer or only coat.

## Composition

## Pigment

83% (min)

## Zinc

93% (min)

82% (dry film)

## Other

## Vehicle

17% (max)

## Volatile

## Nonvolatile

## Other

## Specification

Ameron Dimetecote  
EZ IIAmeron Dimetecote Steel  
Primer 1M

## Description

Single-component  
inorganic zinc coat-  
ing for use on  
structural steels in  
a marine or land  
environment as a  
primer or only coat.Single-component  
inorganic zinc-rich  
primer for use on  
steel surfaces as a  
preconstruction or  
shop primer.

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other

## SECTION A

38

39

## Specification

Ameron Dimetecote  
Steel Primer 2

Ameron Dimetecote 3

## Description

Self-curing, weld-  
able primer for  
use on steel  
surfaces.Post-cured inorganic  
zinc primer for  
maintenance, tank  
lining, and permanent  
priming on steel surface

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other

## SECTION A

40

41

## Specification

Ameron Dimetecote 4

Ameron Dimetecote 4  
Food Grade

## Description

Water-based, self-  
cure inorganic zinc  
primer for mainten-  
ance, tank lining and  
marine use on steel  
surfaces.Water-based, self-  
cure inorganic zinc  
primer for steel tank  
lining.

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other

## SECTION A

42

43

## Specification

Ameron Dimetecote 5

Ameron Dimetecote 6

## Description

Self-cure or post  
cure water-based  
inorganic zinc  
primer for maint-  
enance, marine,  
and permanent  
priming of steel  
surfaces.

Inorganic zinc coating  
for use on steel  
surfaces which cures  
through solvent release  
and reaction with  
atmospheric moisture.

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other

## SECTION A

44

45

## Specification

Ameron Dimetecote 8

Ameron Dimetecote 9

## Description

Inorganic, chemically  
cured zinc silicate  
coating for use in  
tank lining.

Inorganic zinc-rich  
coating for use on  
blasted or pickled  
steel surfaces which  
cures through solvent  
release and reaction  
with atmospheric  
moisture.

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other

## SECTION A

46

47

Specification Ameron Dimetecote 9FT Ameron Dimetecote 10

## Description

Inorganic zinc-rich coating for use on steel surfaces as a topcoat or primer which cures through solvent release and reaction with atmospheric moisture.

Nonflammable, water-based self-curing inorganic zinc coating used on steel structures exposed to salt spray and extreme weathering.

## Composition

## Pigment

Zinc

Other

## Vehicle

Volatile

Nonvolatile

Other



SECTION A

48

Specification	Carboline Company Revised Specification <u>Painting</u> <u>Existing Steel Bridge</u> <u>Structures</u>
Description	Single-component, self- curing inorganic zinc rich coating.

Composition

Pigment

Zinc	80% (min) dry film
------	--------------------

Other	
-------	--

Vehicle

Volatile

Nonvolatile

Other

## SECTION B

### Ingredients

This section contains all requirements regarding composition and properties of a single ingredient.

SECTION B

1

2

Specification

DOD-P-21035A  
(Navy)

MIL-P-23236  
(Ships) Class III

Ingredients

Pigment

Zinc dust (metallic  
zinc powder), dry  
(TT-P-460)

Zinc dust

Vehicle

Inorganic silicate,  
phosphate or silicone

## SECTION B

3

4

## Specification

MIL-P-38336  
(USAF)MIL-P-19453A  
(Ships) Class I

## Ingredients

## Pigment

Zinc dust (metallic  
zinc powder), dry  
(TT-P-460)Zinc yellow (chromate)  
dry (TT-P-465)  
Lampblack, dry (TT-P-350)  
Venetian red, dry (TT-P-  
457)  
Mica (extender pigment)  
(MIL-M-15176)  
Diatomaceous silica  
(MIL-S-5191)  
Lead linoleate (MIL-L-  
17190)

## Vehicle

Tung oil, raw (TT-T-775)  
Turpentine, gum spirit  
(TT-T-801)  
Xylene (TT-X-916)  
Linseed oil, alkali-  
refined (MIL-L-15180)  
Resin, para-phenyl, phenol  
formaldehyde (MIL-R-  
15184)

## SECTION B

5

6

## Specification

MIL-P-19453A  
(Ships) Class IIMIL-P-26915A  
Class A

## Ingredients

## Pigment

Zinc yellow,  
(chromate) dry  
(TT-P-465)  
Lampblack, dry (TT-  
P-350)  
Venetian red, dry  
(TT-P-457)  
Mica, extender  
pigment (MIL-M-  
15176)  
Diatomaceous silica  
(MIL-S-5191)  
Lead linoleate (MIL-  
L-17190)

Zinc dust (metallic zinc  
powder), dry (TT-P-460)

## Vehicle

Tung oil, raw (TT-  
T-775)  
Turpentine, gum  
spirits (TT-T-801)  
Xylene (TT-X-916)  
Linseed oil, alkali  
refined (MIL-L-15180)  
Resin, para phenyl  
phenol-formaldehyde  
(MIL-R-15184)

Thinner, paint (TT-T-291)  
Toluene, technical (TT-T-  
548)  
Enamel, alkyd gloss (TT-  
E-489)  
Lacquer, cellulose nitrate  
gloss, for aircraft  
(TT-L-32)  
Lacquer, acrylic-nitrocellu-  
lose, gloss (MIL-L-  
19537)  
Lacquer, acrylic-nitro-  
cellulose, camouflage  
(MIL-L-19538)  
Coating, polyurethane,  
thermal resistant (MIL-  
C-27227)

## SECTION B

7

8

## Specification

MIL-P-26915A  
Class B

MIL-P-15145B

## Ingredients

## Pigment

Zinc dust, (metallic  
zinc powder), dry  
(TT-P-460)Zinc dust (metallic  
zinc powder), dry  
(TT-P-460)  
Zinc oxide, dry and  
paste-in-oil (TT-Z-301)  
Aluminum stearate (MIL-  
A-15206)

## Vehicle

Thinner, paint (TT-  
T-291)  
Toluene, technical,  
TT-T-548)  
Enamel, alkyd gloss .  
(TT-E-489)  
Lacquer, cellulose  
nitrate, gloss, for  
aircraft (TT-L-32)  
Lacquer, acyclic-nitro-  
cellulose, gloss  
(MIL-L-19537)  
Lacquer, acrylic-nitro-  
cellulose, camouflage  
(MIL-L-19538)  
Coating, polyurethane,  
thermal resistant  
(MIL-C-27227)Thinner, paint (TT-T-  
291)  
Varnish, mixing, phenolic  
(MIL-V-15218)  
Drier, paint, naphthenate  
liquid (cobalt and  
manganese) (TT-D-643)

SECTION B

9

10

Specification

NASA/KSC F-0008  
Type I, Class I

NASA/KSC F-0008  
Type I, Class II

Ingredients

Pigment

Zinc dust (metallic  
zinc powder), dry,  
(TT-P-460)

Zinc dust, (metallic  
zinc powder), dry  
(TT-P-460)

Vehicle

SECTION B

11

12

Specification

NASA/KSC F-0008  
Type II, Class I

NASA/KSC F-0008  
Type II, Class II

Ingredients

Pigment

Zinc dust (metallic  
zinc powder), dry,  
(TT-P-460)

Zinc dust, (metallic  
zinc powder), dry  
(TT-P-460)

Vehicle



## SECTION B

13

14

## Specification

TT-P-641G  
Type ITT-P-641G  
Type II

## Ingredients

## Pigment

Zinc dust (ASTM  
D 520)  
Zinc oxide (ASTM  
D 79)Zinc dust (ASTM D 520)  
Zinc oxide (ASTM D 79)

## Vehicle

Resin, alkyd solu-  
tions (TT-R-266)  
Thinner, paint  
(TT-T-291)Resin, phenol-  
formaldehyde para-  
phenyl (TT-R-271)  
Tung oil, raw (TT-T-775)  
Linseed oil, boiled  
(TT-L-190)  
Thinner, synthetic  
resin enamel (TT-T-306)

## SECTION B

15

16

## Specification

TT-P-641G  
Type IIIAASHTO Proposed Revision  
Painting Metal Structure  
Sec. 14 (Inorganic)

## Ingredients

## Pigment

Zinc dust, (ASTM  
D 520)  
Zinc oxide,  
(ASTM D 79)

Zinc dust (ASTM D 153)

## Vehicle

Resin, phenol-  
formaldehyde  
para-phenyl  
(TT-R-271)  
Tung oil, raw,  
(TT-T-775)  
Linseed oil,  
boiled, (TT-L-  
190)  
Thinner, synthetic  
resin enamel, (TT-  
T-306)Ethyl silicate, 40% SiO<sub>2</sub>  
content  
Polyvinylbutyral resin  
(MIL-P-15328)  
Secondary butyl alcohol  
(TT-B-848)  
Cyclohexanone  
1,1,2-trichloroethane  
Dioctyl sodium sulfo-  
succinate solution  
in normal propyl alcohol  
Hydrochloric acid 0.25%  
solution of hydrogen  
chloride gas  
Normal propanol

## SECTION B

17

18

## Specification

AASHTO Proposed  
Revision Painting  
Metal Structures,  
Sec. 14 (Organic)California  
DOT 681-80-51

## Ingredients

## Pigment

Zinc dust (TT-P-460,  
type I)  
Zinc oxide (TT-P-463,  
(TT-P-463, type I,  
grades A or B)  
Red iron oxideZinc yellow (TT-P-465)  
type I.  
Zinc oxide (TT-P-463)  
type I, grade A  
Sienna (TT-P-435)  
Magnesium silicate  
(TT-P-103)  
Aluminum stearate  
(MIL-A-15206)

## Vehicle

Polyaryl ether  
Ethylene glycol  
monoethyl ether  
acetate (MIL-E-  
7125)  
Toluene (TT-T-548)Alkyd resin solution  
(Cal. DOT 681-80-430)  
Thinner (TT-T-291)  
grade I  
Driers (TT-D-643)

## SECTION B

19

20

## Specification

California  
DOT 681-80-56California  
DOT 741-80-62

## Ingredients

## Pigment

Zinc dust (TT-P-460),  
type I  
Red iron oxide  
Zinc oxide (TT-P-463)  
type I, grade A or  
B.Zinc chromate  
Magnesium silicate  
(MIL-M-15173, type A  
or B)  
Lampblack, (TT-P-350)  
Zinc dust (TT-P-460)  
type I

## Vehicle

Polyaryl ether  
Ethylene glycol  
Monothyl ether  
Acetate (MIL-E-7125)  
Toluene (TT-T-548)Butyl alcohol, normal  
(TT-B-846)  
Ethyl alcohol (O-E-760  
grade III)  
Phosphoric acid (O-D-640  
grade I)

## SECTION B

21

22

## Specification

California  
DOT 701-80-52California  
DOT 8010-61J-36

## Ingredients

## Pigment

Zinc chromate (insol-  
uble type)  
Magnesium silicate  
(MIL-M-15173, type A  
or B)  
Lampblack (TT-P-350)Zinc dust (metallic zinc  
powder), dry (TT-P-463  
type I, grade A or B)  
Red iron oxide  
Zinc oxide (TT-P-463  
type I, grade A or B)

## Vehicle

Butyl alcohol, normal  
(TT-B-846)  
Ethyl alcohol (O-E-  
760 grade III)  
Polyvinyl butyral  
resin  
Phosphoric acid (O-  
0-670, class I)  
Ethyl alcohol (O-E-760  
grade III)Polyaryl ether  
Ethylene glycol mono-  
ethyl ether acetate  
(MIL-E-7125)  
Toluene (TT-T-548)

## SECTION B

23

24

## Specification

North Carolina DOT  
8.1558304 (Two-  
Component)North Carolina DOT  
8.1558304 (Single  
Component)

## Ingredients

## Pigment

Zinc dust (metallic  
zinc powder), dry,  
TT-P-460, type I,  
regularZinc dust (metallic  
zinc powder), dry  
TT-P-460, type I,  
regular

## Vehicle

Ethyl silicate

Polyaryl ether in  
appropriate solvent

## SECTION B

25

26

## Specification

Indiana DOT Painting  
Structural Steel,  
sec. V-AIndiana DOT Painting  
Structural Steel,  
sec. V-B

## Ingredients

## Pigment

Zinc powder: 96%  
metallic powderZinc powder: 96%  
metallic zinc

## Vehicle

Pre-hydrolyzed acid  
catalyzed ethyl  
silicate in  
appropriate solventEthyl silicate in  
appropriate solvent

SECTION B.

27

Specification

Iowa DOT-4182.02

Ohio supplement 950

Ingredients

Pigment

Zinc dust

Zinc dust; ASTM D 520

Vehicle

Partially hydrolyzed  
ethyl silicate in  
appropriate alcohol  
solvent



SECTION B

29

Specification

Ohio Supplement  
950 (Single Component)

Ingredients

Pigment

Zinc dust (ASTM D 520)

Vehicle

Partially hydrolyzed  
ethyl silicate in  
appropriate alcohol  
solvent

## SECTION B

30

31

Specification

Florida DOT 971.14

Canadian Gov't.  
Specifications Board  
CGSB 1-GP 171c, Type I

Ingredients

Pigment

Zinc dust (TT-Z-291)  
Lead suboxide  
stabilizer

Zinc dust (ASTM D 520)

Vehicle

Chlorinated rubber  
with suitable  
plasticizer

Silicate solution

## SECTION B

32

33

Specification

Canadian Gov't.  
Specifications Board  
CGSB 1-GP-171c  
Type IISteel Structures  
Painting Council  
SSPC X 20X Type I

Ingredients

Pigment

Zinc dust (ASTM D  
520)Zinc dust (ASTM D  
520)

Vehicle

Silicate solution

SECTION B

34

35

Specification

Steel Structures  
Painting Council  
SSPC X 20X Type II

Ameron Dimetecote EZ

Ingredients

Pigment

Zinc dust

Vehicle

SECTION B

36

37

Specification

Ameron Dimetecote  
EZ II

- - Ameron Dimetecote Steel  
Primer 1M

Ingredients

Pigment

Vehicle

SECTION B

33

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Specification

Ameron Dimetecote  
Steel Primer 2

Ameron Dimetecote 3

Ingredients

Pigment

Vehicle

SECTION B

40

41

Specification

Ameron Dimetcote 4

Ameron Dimetcote 4  
Food Grade

Ingredients

Pigment

Vehicle

SECTION B

42

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Specification

Ameron Dimetecote 5

Ameron Dimetecote 6

Ingredients

Pigment

Vehicle



SECTION B

44

45

Specification

Ameron Dimetecote S

Ameron Dimetecote 9

Ingredients

Pigment

Vehicle

SECTION B

46

47

Specification

Ameron Dimetecote 9FT

Ameron Dimetecote 10

Ingredients

Pigment

Vehicle

SECTION B

48

Specification	Carboline Company Revised Specification <u>Painting</u> <u>Existing Steel Bridge</u> <u>Structures</u>
Ingredients	
Pigment	Zinc dust (ASTM D 520)

Vehicle	Inorganic silicate in appropriate alcohol solvent
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## SECTION C

### Tests

This section contains all requirements regarding test procedures applicable to the pigment, vehicle, or paint as a whole.

## SECTION C

1

2

## Specification

DOD-P-21035A  
(Navy)MIL-P-23236  
(Ships) Class III

## Tests

## Salt Spray

FED STD 141a, method 6061

## Adhesion

FED STD 141a, method 6304

Accelerated  
Weathering

## Color

FED STD 141a, method 4250

## Drying Time

FED STD 141a, method 4061

FED STD 141a, method 4061

## Dry-To-Touch

para 4.2.2

para 4.2.2

## Dry Hard

para 4.2.8

para 4.2.8

## Other

Pigment: FED STD 141a,  
method 4021  
Nonvolatiles: FED STD  
141a, method 4058  
Application: FED STD  
141a, method 2131, 2141  
Condition in container  
FED STD 141a, method 3011  
Weight per gallon: FED  
STD 141a, method 4184  
Viscosity: FED STD 141a,  
method 4281  
Flash point: FED STD  
141a, method 4293  
Total zinc: ASTM D521  
Condition in partially  
full container: FED STD  
141a, method 3021

Pigment: FED STD 141a, method  
4021  
Volatiles: FED STD 141a,  
method 4041  
Nonvolatile vehicle: FED STD  
141a, method 4058  
Viscosity: FED STD 141a,  
method 4281  
Weight per gallon: FED STD  
141a, method 4184  
Fineness of grind: FED STD  
141a, method 4411  
Flash point: FED STD 141a,  
method 4293  
Odor: FED STD 141a, method  
4401  
Color: FED STD 141a, method  
4250  
Directional reflectance  
FED STD 141a, method 6121  
Flexibility: FED STD 141a,  
method 6222  
Application: FED STD 141a,  
method 2131, 2141  
Condition in container: FED  
STD 141a, method 3011

## SECTION C

3

4

## Specification

MIL-P-38336  
(USAF)MIL-P-19453A  
(ShTips) Class I

## Tests

## Salt Spray

## Adhesion

Accelerated  
Weathering

## Color

FED STD 141a,  
Method 4250

FED STD 141a, Method 4248

## Drying Time

FED STD 141a Method 4061.1

## Dry-to-Touch

para. 4.2.2

## Dry Hard

para. 4.2.8

## Other

Flash point: FED  
STD 141a, Method  
4291  
Odor: FED STD 141a,  
Method 4401  
Coarse Particles &  
Skins: FED STD  
141a, Method 4091  
Miscibility: FED  
STD 141a, Method  
4201  
Wt. Per Gallon: FED  
STD 141a, Method  
4184

Ash: FED STD 141a, Method 5261  
Flash point: FED STD 141a,  
Method 4294  
Iodine Number: FED STD Method 5061  
Acid Number: FED STD 141a,  
Method 5072  
Specific Gravity: FED STD 141a,  
Method 4185  
Coarse Particles and Skins:  
FED STD 141a, Method 4092  
Viscosity: FED STD 141a,  
Method 4281  
Wt. Per Gallon: FED STD 141a,  
Method 4184  
Fineness of Grind: FED STD 141a,  
Method 4411  
Odor: FED STD 141a, Method 4401

## SECTION C

5

6

## Specification

MIL-P-19453A  
(Ships) Class IIMIL-P-26915A  
Class A

## Tests

## Salt Spray

## Adhesion

Accelerated  
Weathering

## Color

FED STD 141a, method  
4250

## Drying Time

FED STD 141a, method  
4061.1

## Dry-To-Touch

para. 4.2.2

## Dry Hard

para. 4.2.8

## Other

Ash: FED STD 141a,  
method 5261  
Flash point: FED STD  
141a, method 4294  
Iodine Number: FED STD  
method 5061  
Acid Number: FED STD  
141a, method 5072  
Specific Gravity: FED  
STD 141a, method 4185  
Coarse Particles and  
Skins: FED STD 141a,  
method 4092  
Viscosity: FED STD  
141a, method 4281  
Wt. Per Gallon: FED  
STD 141a, method 4184  
Fineness of Grind: FED  
STD 141a, method 4411  
Odor: FED STD 141a,  
method 4401

Pigment: FED STD 141a, method  
4021  
Volatiles: FED STD 141a, method  
4021  
Nonvolatile vehicle: FED STD  
141a, method 4053  
Water: FED STD 141a, method 4081  
Coarse particles and skins: FED  
STD 141a, method 4091  
Viscosity: FED STD 141a, method  
4184  
Weight per gallon: FED STD 141a,  
method 4184  
Fineness of grind: FED STD 141a,  
method 4411  
Odor: FED STD 141a, method 4401  
Rosin and rosin derivatives:  
FED STD 141a, method 5031  
Phenolic resins: FED STD 141a,  
method 5141  
Flash point: FED STD 141a,  
method 4291  
Zinc oxide: method 7091

## SECTION C

7

8

## Specification

MIL-P-26915A  
Class B

MIL-P-15145B

## Tests

Salt Spray

Adhesion

Accelerated  
Weathering

Color

Drying Time

FED STD 141a

Dry-To-Touch

para. 4.2.2

Dry Hard

para. 4.2.2

Other

Pigment: FED STD 141a,  
method 4021  
 Volatiles: FED STD 141a,  
method 4021  
 Nonvolatile vehicle: FED  
STD 141a, method 4053  
 Water: FED STD 141a,  
method 4081  
 Coarse particles and skins:  
FED STD 141a, method 4091  
 Viscosity: FED STD 141a,  
method 4184  
 Weight per gallon: FED STD  
141a, method 4184  
 Fineness of grind: FED STD  
141a, method 4411  
 Odor: FED STD 141a, method  
4401  
 Rosin and rosin derivatives:  
FED STD 141a, method 5031  
 Phenolic resins: FED STD  
141a, method 5141  
 Flash point: FED STD 141a,  
method 4291  
 Zinc oxide: method 7091

Pigment: FED STD-141a,  
method 4021  
 Volatiles: FED STD 141a,  
method 4041  
 Nonvolatile vehicle: FED  
STD 141a, method 4053  
 Water: FED STD 141a, method  
4081  
 Coarse particles and skins:  
FED STD 141a, method 4091  
 Viscosity: FED STD 141a,  
method 4281  
 Weight per gallon: FED STD  
141a, method 4184  
 Fineness of grind: FED STD  
141a, method 4411  
 Odor: FED STD 141a, method  
4401  
 Rosin and rosin derivatives:  
FED STD 141a, method 5031  
 Phenolic resins: FED STD 141a,  
method 5141  
 Flash point: FED STD 141a,  
method 4291



## SECTION C

9

10

## Specification

NASA/KSC F-0008  
Type I, Class INASA/KSC F-0008  
Type I, Class II

## Tests

## Salt Spray

FED STD 141a, method 6061  
(panels not scored)FED STD 141a, method 6061  
(panels not scored)

## Adhesion

Accelerated  
Weathering

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Pigment: FED STD 141a,  
method 4312  
Nonvolatiles: FED STD 141a,  
method 4312  
Metallic zinc: FED STD  
141a, method 7221  
Volatiles: FED STD 141a,  
method 4312  
Weight per gallon: FED STD  
141a, method 4184  
Viscosity: FED STD 141a,  
method 4281  
Flash point: FED STD 141a,  
method 4294

Pigment: FED STD 141a,  
method 4312  
Nonvolatiles: FED STD 141a,  
method 4312  
Metallic zinc: FED STD  
141a, method 7221  
Volatiles: FED STD 141a,  
method 4312  
Weight per gallon: FED STD  
141a, method 4184  
Viscosity: FED STD 141a,  
method 4281  
Flash point: FED STD 141a,  
method 4294

## SECTION C

11

12

## Specification

NASA/KSC F-0008  
Type II, Class INASA/KSC F-0008  
Type II, Class II

## Tests

## Salt Spray

FED STD 141a, method 6061  
(panels not scored)FED STD 141a, method 6061  
(panels not scored)

## Adhesion

Accelerated  
Weathering

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Pigment: FED STD 141a,  
method 4312  
Nonvolatiles: FED STD 141a,  
method 4312  
Metallic zinc: FED STD  
141a, method 7221  
Volatiles: FED STD 141a,  
method 4312  
Weight per gallon: FED STD  
141a, method 4184  
Viscosity: FED STD 141a,  
method 4281  
Flash point: FED STD 141a,  
method 4294

Pigment: FED STD 141a,  
method 4312  
Nonvolatiles: FED STD 141a,  
method 4312  
Metallic zinc: FED STD  
141a, method 7221  
Volatiles: FED STD 141a,  
method 4312  
Weight per gallon: FED STD  
141a, method 4184  
Viscosity: FED STD 141a,  
method 4281  
Flash point: FED STD 141a,  
method 4294

## SECTION C

13

14

## Specification

TT-P-641G  
Type ITT-P-641G  
Type II

## Tests

## Salt Spray

## Adhesion

Accelerated  
Weathering

## Color

FED STD 141a, method  
4250FED STD 141a, method  
4250

## Drying Time

FED STD 141a, method  
4061FED STD 141a, method  
4061

## Dry-To-Touch

para. 4.2.2

para. 4.2.2

## Dry Hard

para. 4.2.8

para. 4.2.8

## Other

Condition in container:

FED STD 141a, method  
3011Skinning: FED STD 141a,  
method 3021Spraying properties:  
FED STD 141a, method  
4331

Odor: ASTM D 1296

Rosin: ASTM D 1542,  
sec. 4aWater resistance: FED  
STD 141a, method 5011Weight per gallon:  
ASTM D 1475Pigment: FED STD 141a,  
method 4021Nonvolatile vehicle:  
FED STD 141a, method  
4051Water: FED STD 141a,  
method 4081Coarse particles and  
skins: ASTM D 185,  
sec. 6

Viscosity: ASTM D 562

Condition in container:

FED STD 141a, method  
3011Skinning: FED STD 141a,  
method 3021Spraying properties:  
FED STD 141a, method  
4331

Odor: ASTM D 1296

Rosin: ASTM D 1542,  
sec. 4aWater resistance: FED  
STD 141a, method 5011Weight per gallon:  
ASTM D 1475Pigment: FED STD 141a,  
method 4021Nonvolatile vehicle:  
FED STD 141a, method  
4051Water: FED STD 141a,  
method 4081Coarse particles and  
skins: ASTM D 185,  
sec. 6

Viscosity: ASTM D 562

## SECTION C

15

16

Specification

TT-P-641G  
Type IIIAASHTO Proposed Revision  
Painting Metal Structures  
Sec. 14 (Inorganic)

Tests

Salt Spray

ASTM B 117

Adhesion

FED STD 141a, method 6222

Accelerated  
Weathering

Color

FED STD 141a, method 4250

Drying Time

FED STD 141a, method 4061,  
4.2.2, 4.2.8

Dry-To-Touch

Dry Hard

Other

Fineness of grind: Fisher  
sub-sieve sizersInfrared characteristic  
curve: DOT fileX-ray diffraction curve:  
DOT fileViscosity: FED STD 141a,  
method 4281Metallic zinc: FED STD 141a,  
method 7221

Storage life:

Pencil Hardness:

## SECTION C

17

18

## Specification

AASHTO Proposed  
Revision Painting  
Metal Structures,  
Sec. 14 (Organic)

California  
DOT 681-80-51

## Tests

## Salt Spray

ASTM B 117

## Adhesion

FED STD 141a, method 6222

Accelerated  
Weathering

## Color

FED STD 141a, method 4250

## Drying Time

FED STD 141a, method 4061,  
4.2.2, 4.2.8

FED STD 141, method 4061

## Dry-To-Touch

para. 4.2.2

## Dry Hard

para. 4.2.8

## Other

Fineness of grind: Fisher  
sub-sieve sizers  
Infrared characteristic  
curve: DOT file  
X-ray diffraction curve:  
DOT file  
Viscosity: FED STD 141a,  
method 4281  
Metallic zinc: FED STD 141a,  
method 7221  
Storage life:  
Pencil Hardness:

Total zinc: FED STD 141a,  
method 7221  
Specific gravity of zinc  
dust: ASTM D 153  
Viscosity: FED STD 141a,  
method 4281  
Weight per gallon: FED  
STD 141a, method 4184  
Storage life: FED STD  
141a, method 3011

## SECTION C

19

20

## Specification

California  
DOT 681-80-56California  
DOT 741-80-62

## Tests

## Salt Spray

ASTM B 117

ASTM B 117

## Adhesion

FED STD 141a, method 6222

FED STD 141a, method 6222

Accelerated  
Weathering

## Color

California DOT 691-80-450

## Drying Time

FED STD 141a, method 4061

FED STD 141a, method 4061,

## Dry-To-Touch

para. 4.2.2

para. 4.2.2

## Dry Hard

para. 4.2.8

para. 4.2.8

## Other

Total zinc: FED STD 141a,  
method 7221  
Specific gravity: ASTM  
D 153  
Viscosity: FED STD 141a,  
method 4281  
Weight per gallon: FED STD  
141a, method 4184  
Storage lifePencil Hardness:  
Infrared characteristic  
curve:  
X-ray diffraction curve

## SECTION C

21

22

## Specification

California  
DOT 701-80-52California  
DOT 8010-61J-36

## Tests

## Salt Spray

ASTM B 117

ASTM B 117

## Adhesion

Accelerated  
Weathering

## Color

## Drying Time

FED STD 141a, method  
4061FED STD 141a, method  
4061

## Dry-To-Touch

para. 4.2.2

para. 4.2.2

## Dry Hard

para. 4.2.8

para. 4.2.8

## Other

Viscosity: ASTM D 1243  
Weight per gallon  
Fineness of grind  
Coarse particles and  
skins: RR-S-366Viscosity: ASTM D 1243  
Weight per gallon  
Fineness of grind  
Coarse particles and  
skins: RR-S-366

## SECTION C

23

24

## Specification

North Carolina DOT  
8.1558304 (Two-  
Component)North Carolina DOT  
8.1558304 (Single  
Component)

## Tests

## Salt Spray

ASTM B 117

ASTM B 117

## Adhesion

Accelerated  
WeatheringASTM G23 69  
type DASTM G23 69  
type D

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Fresh water resistance  
Salt water resistanceFresh water resistance  
Salt water resistance



## SECTION C

25

26

Specification	<u>Indiana DOT Painting Structural Steel, sec. V-A</u>	<u>Indiana DOT Painting Structural Steel, sec. V-B</u>
Tests		
Salt Spray	Test method Iowa 811	Test method Iowa 811
Adhesion		
Accelerated Weathering		
Color	Test method Iowa 811	Test method Iowa 811
Drying Time		
Dry-To-Touch		
Dry Hard		
Other	Fresh water resistance Resistance to elevated temperatures and thermal shock	Test method Iowa 811

## SECTION C.

27

28

Specification

Iowa DOT 4182.02

Ohio Supplement 950

Tests

Salt Spray

Iowa test method 811

ASTM B 117

Adhesion

Accelerated  
Weathering

ASTM G 73, type D

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Fresh water resistance  
Resistance to elevated  
temperature and thermal  
shock: Iowa test method  
811  
Storage life of vehicle:  
Iowa test method 811

Fresh water resistance  
Iowa test method 811  
Resistance to elevated  
temperatures and thermal  
shock test method 811  
Salt water resistance

SECTION C

29

Specification

Ohio Supplement  
950 (Single Component)

Tests

Salt Spray

ASTM B 117

Adhesion

Accelerated  
Weathering

ASTM G 73, type D

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Fresh water resistance  
Iowa test method 811  
Resistance to elevated  
temperatures and thermal  
shock test method 811  
Salt water resistance

## SECTION C

30

31

## Specification

Florida DOT 971.14

Canadian Gov't.  
Specifications Board  
CGSB 1-GP 171c, Type I

## Tests

## Salt Spray

FED STD 141a, method 6061

CGSB 1-GP-71, method 129.2

## Adhesion

FED STD 141a, method 6304

Accelerated  
Weathering

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Abrasion resistance: FED  
STD 141a, method 6192CGSB 1-GP-71, method 5.1  
Flash point: CGSB 1-GP-71,  
method 3.1  
Coarse particles: ASTM D 185  
Immersion test: CGSB  
1-GP-71, method 110.1

Specification	Canadian Gov't. Specifications Board	Steel Structures Painting Council
Tests	CGSB 1-GP-171c Type II	SSPC X 20X Type I
Salt Spray	CGSB 1-GP-71, method 129.2	ASTM B 117
Adhesion		ASTM D 3359
Accelerated Weathering		
Color		
Drying Time		
Dry-To-Touch		
Dry Hard		
Other	CGSB 1-GP-71, method 5.1 Flash point: CGSB 1-GP-71, method 3.1 Coarse particles: ASTM D 185 Immersion test: CGSB 1-GP-71, method 110.1	Viscosity: FED STD 141a, method 4281, 4282 or ASTM D 562 Solids: FED STD 141a, method 4041.1 or ASTM D 2369 Weight per gallon: FED STD 141a, method 4184.1

## SECTION C

34

35

## Specification

Steel Structures  
Painting Council  
SSPC X 20X Type II

Ameron Dimetecote EZ

## Tests

## Salt Spray

ASTM B 117

## Adhesion

ASTM D 3359

Accelerated  
Weathering

## Color

## Drying Time

## Dry-To-Touch

ASTM D 1640

## Dry Hard

ASTM D 1640

## Other

Viscosity: FED STD 141a,  
method 4281, 4282 or  
ASTM D 562Solids: FED STD 141a,  
method 4041.1 or ASTM  
D 2369Weight per gallon: FED  
STD 141a, method 4184.1

Flash point: ASTM D 1310

## SECTION C

36

37

## Specification

Ameron Dimetecote  
EZ IIAmeron Dimetecote Steel  
Primer 1M

## Tests

Salt Spray

Adhesion

Accelerated  
Weathering

Color

## Drying Time

Dry-To-Touch

ASTM D 1640

ASTM D 1640

Dry Hard

ASTM D 1640

ASTM D 1640

Other

Flash point:  
ASTM D 3278Flash point:  
ASTM D 1310

## SECTION C

38

39

## Specification

Ameron Dimetecote  
Steel Primer 2

Ameron Dimetecote 3

## Tests

Salt Spray

Adhesion

Accelerated  
Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

ASTM D 1640

ASTM D 1640

Flash point:  
ASTM D 1310  
Pot life

Flash point: ASTM D 1310

Pot life



## SECTION C

40

41

## Specification

Ameron Dimetecote 4

Ameron Dimetecote 4  
Food Grade

## Tests

## Salt Spray

## Adhesion

Accelerated  
Weathering

## Color

## Drying Time

## Dry-To-Touch

ASTM D 1640

ASTM D 1640

## Dry Hard

ASTM D 1640

ASTM D 1640

## Other

Pot life  
Flash pointPot life  
Flash point

## SECTION C

42

43

## Specification

Ameron Dimetecote 5

Ameron Dimetecote 6

## Tests

Salt Spray

Adhesion

Accelerated  
Weathering

Color

## Drying Time

Dry-to-Touch

ASTM D 1640

ASTM D 1640

Dry Hard

ASTM D 1640

ASTM D 1640

## Other

Pot life  
Flash point:  
ASTM D 1310Pot life  
Flash point:  
ASTM D 1310

## SECTION C

44

45

Specification

Ameron Dimetecote 8

Ameron Dimetecote 9

Tests

Salt Spray

Adhesion

Accelerated  
Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Flash point: ASTM  
D 1310  
Pot lifeFlash point: ASTM D 1310  
Pot life

## SECTION C

46

47

## Specification

Ameron Dimetecote 9FT

Ameron Dimetecote 10

## Tests

## Salt Spray

## Adhesion

Accelerated  
Weathering

## Color

## Drying Time

## Dry-To-Touch

ASTM D 1640

ASTM D 1640

## Dry Hard

ASTM D 1640

ASTM D 1640

## Other

Pot life  
Flash point: ASTM  
D 1310Pot life  
Flash point: ASTM  
D 1310

SECTION C

48

Specification	Carboline Company Revised Specification <u>Painting</u> <u>Existing Steel Bridge</u> <u>Structures</u>
Tests	
Salt Spray	ASTM B 117
Adhesion	
Accelerated Weathering	ASTM G 23-69 type D
Color	
Drying Time	
Dry-To-Touch	
Dry Hard	
Other	Fresh water resistance Salt water resistance

## SECTION D

### Requirements

This section contains all requirements regarding properties of the element, vehicle, or paint as a whole, including results of tests specified in section C.

## SECTION D

1

2

## Specification

DOD-P-21035A  
(Navy)MIL-P-23236  
(Ships) Class III

## Requirements

Qualified  
Products  
List (?)

Yes

## Salt Spray

less than 5% rust,  
no film failure

## Adhesion

no loss of adhesion,  
flaking or powdering

## Weathering

## Color

Characteristic of components  
uniform, lot to lot.

## Drying Time

to be reported

24 hrs. (max)  
7 days (max)

## Dry-To-Touch

## Dry Hard

## Other

Pigment: see composition  
 Nonvolatiles: see composition  
 Application: good adhesion, smooth uniform appearance  
 Condition in container: no livering, gelling or curdling after 1 yr.  
 Weight per gallon: 5.455 kg (12 lb)  
 Viscosity: to be reported  
 Flash point: 38 C (100 F)  
 Total zinc: See composition  
 Condition in partially full container: no skinning

Pigment: see composition  
 Volatiles: see composition  
 Nonvolatile vol: see composition  
 Viscosity: to be reported  
 Weight per gallon: to be reported  
 Fineness of grind: to be reported  
 Flashpoint: 100 F (min)  
 Odor: to be reported  
 Directional reflectance: to be reported  
 Flexibility: to be reported  
 Application: good spraying and leveling characteristics  
 Condition in container: no livering, increase beyond 15 Klu or five hrs drying time after 1 yr

# SECTION D

	3	4
Specification	MIL-P-38336 (USAF)	MIL-P-19453A (Ships) Class I
Requirements		
Qualified Products List (?)		
Salt Spray		
Adhesion		
Weathering		
Color	Characteristic of Components	Characteristic of Pigments used, same as standard color card.
Drying Time		
Dry-to Touch		
Dry Hard		3 hrs. (max)
Other	Flash point: to be reported Odor: Not obnoxious Coarse particles and skins: 0.5% of sieve test residue. Miscibility: compatible with denatured alcohol (MIL-A-6091) and ethylene glycol mono- ethyl ether (TT-E-871 in 1:1 ratio Wt. per gallon: 18 lb	Ash: 0.2% (max) of varnish Flash point: 150 C (min) Iodine Number: 60 (max) Acid Number: 1.0 (max) Specific Gravity: 1.07 - 1.14 Coarse particles & skins: 0.2 (max) % Viscosity: 77 - 82K Wt. per gallon: 11.5 - 12.5 Fineness of grind: 100 mesh Odor: normal



AD-A093 495

ARTECH CORP FALLS CHURCH VA  
REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS, (11)

F/G 11/3

SEP 79 F ORDWAY, M J HAMMELL

N00600-76-D-0511

UNCLASSIFIED

ARTECH-J7600.159-FR

DTNSRDC-TM-28-A0-51-SUPPL NL

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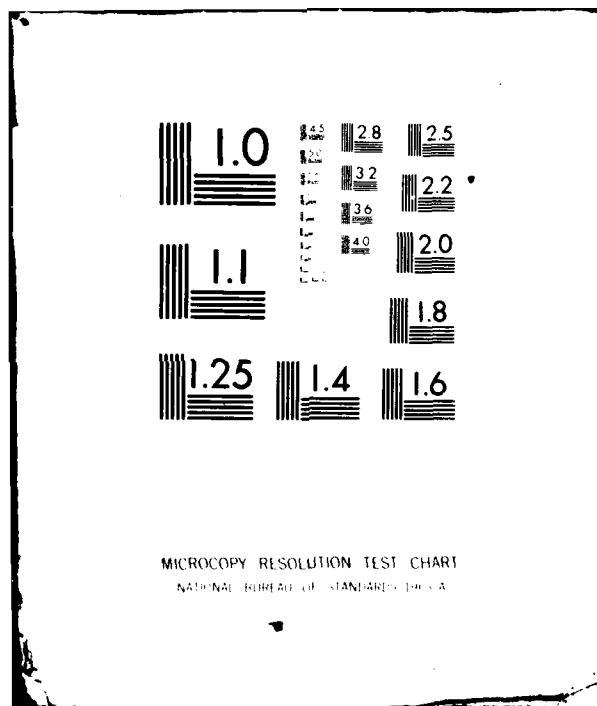
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## SECTION D

5

6

## Specification

MIL-P-19453A  
(Ships) Class IIMIL-P-26915A  
Class A

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Characteristic of Pig-  
ments used, same as  
standard color card.Characteristics of zinc pigment,  
and color number 36231, FED  
STD 595

Drying Time

Dry-To-Touch

Dry Hard

3 hrs. (max)

Other

Ash: 0.2% (max) of  
varnish  
Flash point: 150 C  
(min)  
Iodine Number: 60 (max)  
Acid Number: 1.0 (max)  
Specific Gravity:  
1.07 - 1.14  
Coarse particles &  
skins: 0.2 (max) %  
Viscosity: 77 - 82KU  
Wt. per gallon: 11.5 -  
12 lb  
Fineness of grind: 5  
(min)  
Odor: normalNonvolatiles: see composition  
Rosin: to be reported  
Water: 0.25% (max)  
Flash point: 80 F (min)  
Odor: not obnoxious  
Coarse particles and skins: 0.5%  
(max)  
Miscibility: Compatible with  
mineral spirits (TT-T-291) and  
Toluene (TT-T-548) in 1:1 ratio  
Skinning: none after 48 hrs  
Weight per gallon: 16.3 lb (min)

## SECTION D

7

8

## Specification

MIL-P-26915A  
Class B

MIL-P-15145B

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Characteristic of zinc  
pigment, and color  
number 36231, FED STD  
595

Drying Time

Dry-To-Touch

0.5 hrs

Dry Hard

4.0 hrs

Other

Nonvolatiles: see  
composition  
Rosin: to be reported  
Water: 0.25% (max)  
Flash point: 80 F (min)  
Odor: not obnoxious  
Coarse particles and  
skins: 0.5% (max)  
Miscibility: Compatible  
with mineral spirits  
(TT-T-291) and Toluene  
(TT-T-548) in 1:1 ratio  
Skinning: none after 48  
hrs  
Weight per gallon: 16.3  
lb (min)Pigment: see composition  
Volatiles: 47-50% (max)  
Nonvolatile vehicle: 17-20.5%  
(min)  
Water: 0.5% (max)  
Coarse particles and skins:  
0.5% (max)  
Viscosity: 57-67 Krebs units  
Weight per gallon: 9.2-9.6 lbs  
Fineness of grind: 4 (min)  
Odor: to be normal  
Rosin and rosin derivatives:  
to be absent  
Phenolic resin: to be present  
Flash point: 100 F (min)

## SECTION D

9

10

## Specification

NASA/KSC F-0008  
Type I, Class INASA/KSC F-0008  
Type I, Class II

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Results reported with  
samples and photographsResults reported with samples  
and photographs

Adhesion

Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Pigment: see ingredients  
Nonvolatiles: to be reported  
Metallic zinc: to be reported  
Volatiles: to be reported  
Weight per gallon:  
Type I, Class I: 16 lb  
Viscosity: to be reported  
Flash point: to be reportedPigment: see ingredients  
Nonvolatiles: to be reported  
Metallic zinc: to be reported  
Volatiles: to be reported  
Weight per gallon:  
Type I, Class II: 21 lb  
Viscosity: to be reported  
Flash point: to be reported

## SECTION D

11

12

## Specification

NASA/KSC F-0008  
Type II, Class INASA/KSC F-0008  
Type II, Class II

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Results reported with  
samples and photographsResults reported with samples  
and photographs

Adhesion

Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Pigment: see ingredients  
Nonvolatiles: to be reported  
Metallic zinc: to be reported  
Volatiles: to be reported  
Weight per gallon:  
Type II, Class I: 13 lb  
Viscosity: to be reported  
Flash point: to be reportedPigment: see ingredients  
Nonvolatiles: to be reported  
Metallic zinc: to be reported  
Volatiles: to be reported  
Weight per gallon:  
Type II, Class II: 13 lb  
Viscosity: to be reported  
Flash point: to be reported

## SECTION D

13

14

## Specification

TT-P-641G  
Type ITT-P-641G  
Type II

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Gray

Gray

## Drying Time

Dry-To-Touch

1-1/2 - 4 hr

1-1/2 - 4 hr

Dry Hard

18 hr (max)

18 hr (max)

## Other

Condition in container:  
capable of being  
mixed readily by hand  
Skinning: none in 48  
hours in 3/4-full  
closed container  
Spraying properties:  
satisfactory in all  
respects  
Odor: normal for vola-  
tiles permitted  
Rosin: to pass 80%  
rosin pentahythritol  
later reduction test  
Water resistance: no  
checking, blistering  
or whitening 5 min-  
utes after immersion  
Weight per gallon:  
23 lb  
Pigment: see composi-  
tion  
Nonvolatile vehicle:  
see composition

Condition in container:  
capable of being  
mixed readily by hand  
Skinning: none in 48  
hours in 3/4-full  
closed container  
Spraying properties:  
satisfactory in all  
respects  
Odor: normal for vola-  
tiles permitted  
Rosin: to pass 80%  
rosin pentahythritol  
later reduction test  
Water resistance: no  
checking, blistering  
or whitening 5 min-  
utes after immersion  
Weight per gallon: 16 lb  
Pigment: see composition  
Nonvolatile vehicle: see  
composition

## SECTION D (cont'd)

13

14

## Specification

TT-P-641G  
Type ITT-P-641G  
Type II

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Water: 0.1% (max)  
Coarse particles and  
skins: 4% (max)  
Viscosity: 82-98 Krebs  
unitsWater: 0.1% (max)  
Coarse particles and  
skins: 4% (max)  
Viscosity: 67-86 Krebs units



## SECTION D

15

16

## Specification

TT-P-641G  
Type IIIAASHTO Proposed Revision  
Painting Metal Structures,  
Sec. 14 (Inorganic)

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No surface corrosion after  
3000 hrs

## Adhesion

No loosening of film above  
longest continuous crack

## Weathering

## Color

Gray

To contrast to blast-cleaned  
metal and finish coat

## Drying Time

Dry-To-Touch 1-1/2 - 4 hr

1/2 hr (max)

Dry Hard 18 hr (max)

2 hr (max)

## Other

Condition in container:  
capable of being  
mixed readily by hand  
Skinning: none in 48  
hours in 3/4-full  
closed container  
Spraying properties:  
satisfactory in all  
respects  
Odor: normal for vola-  
tiles permitted  
Rosin: to pass 80%  
rosin pentahythritol  
later reduction test  
Water resistance: no  
checking, blistering  
or whitening 5 min-  
utes after immersion  
Weight per gallon:  
23 lb  
Pigment: see composition  
Nonvolatile vehicle: see  
composition

Fineness of grind: 9 microns  
(max)  
Infrared characteristic  
curve: to match curve  
on file  
X-ray characteristic curve:  
to match curve on file  
Viscosity: 70-80 kreb's  
units  
Metallic zinc: 95% (min)  
Storage life: 1 yr (min)  
Pencil hardness: H

(cont'd)

D - 9

SECTION D (cont'd)

15

16

Specification

TT-P-641G  
Type III

AASHTO Proposed Revision  
Painting Metal Structures,  
Sec. 14 (Inorganic)

Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Water: 0.1% (max)  
Coarse particles and  
skins: 4% (max)  
Viscosity: 82-98 Krebs  
units

## SECTION D

17

18

## Specification

AASHTO Proposed  
Revision Painting  
Metal Structures,  
Sec. 14 (Organic)

California  
DOT 681-80-51

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No surface corrosion after  
3000 hrs

## Adhesion

Do loosening of film above  
longest continuous crack

## Weathering

## Color

To contrast to blast-cleaned  
metal and finish coat

## Drying Time

1/2 hr (max)

## Dry-To-Touch

2 hr (max)

## Dry Hard

Fineness of grind: 9 microns  
(max)

## Other

Infrared characteristic  
curve: to match curve  
on file

X-ray characteristic curve:  
to match curve on file

Viscosity: 70-80 kreb's  
units

Metallic zinc: 95% (min)

Storage life: 1 yr (min)

Pencil hardness: H

## SECTION D

19

20

## Specification

California  
DOT 681-80-56California  
DOT 741-80-62

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No underfilm corrosion  
beyond scribe lines  
after 1,000 hrNo underfilm corrosion  
beyond scribe lines  
after 1,000 hr

## Adhesion

No loosening of film above  
longest continuous cracksNo loosening of film above  
longest continuous cracks

## Weathering

## Color

Chip no. 42, 691-80-420

## Drying Time

Dry-To-Touch 1/2 hr (max)

3/4 hr (max)

Dry Hard 2 hr (max)

5 hr (max)

## Other

Total zinc: see composi-  
tion  
Specific gravity: 7.00-7.14  
Viscosity: 70-80 kreb's  
units  
Weight per gallon: 21.1-  
21.9 lb  
Storage life: 6 months  
(min)Infrared characteristic  
curve: to match curve  
on file  
X-ray diffraction curve:  
to match curve on file  
Pencil hardness: B (min)

## SECTION D

21

22

## Specification

California  
DOT 701-80-52California  
DOT 8010-61J-36

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No underfilm corrosion  
beyond scribe lines  
after 1,000 hrNo underfilm corrosion  
beyond scribe lines  
after 1,000 hr

## Adhesion

## Weathering

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

30 min (max)

## Other

Viscosity: 57-67 kreb's  
units  
Weight per gallon:  
7.2-7.7 lb  
Fineness of grind: 5 (rim)  
Coarse particles and  
skins: 0.5% (max)

## SECTION D

23

24

## Specification

North Carolina DOT  
8.1558304 (Two-  
Component)North Carolina DOT  
8.1558304 (Single  
Component)

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No loss of bond, rusting or  
blistering beyond 1/16"  
from center of scribe line  
after 1,000 hrNo loss of bond, rusting or  
blistering beyond 1/16"  
from center of scribe line  
after 1,000 hrAdhesion  
Adhesion

## Weathering

No rusting, blistering, or  
loss of adhesion after  
1,000 hrNo rusting, blistering, or  
loss of adhesion after  
1,000 hr

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Fresh water resistance:  
no rusting, softening, or  
blistering after 30 days  
Salt water resistance:  
no rusting, softening, or  
blistering after 30 daysFresh water resistance:  
no rusting, softening, or  
blistering after 30 days  
Salt water resistance:  
no rusting, softening, or  
blistering after 30 days

## SECTION D

25

26

## Specification

Indiana DOT Painting  
Structural Steel,  
sec. V-AIndiana DOT Painting  
Structural Steel,  
sec. V-B

## Requirements

Qualified  
Products  
List (?)

Salt Spray

No loss of bond, rusting  
or blistering beyond 1/16"  
from center of scribe lines  
after 1,000 hrNo loss of bond, rusting  
or blistering beyond 1/16"  
from center of scribe lines  
after 1,000 hrAdhesion  
Adhesion

Weathering

Color

To contrast with blast-  
cleaned surface and finish  
coatTo contrast with blast-  
cleaned surface and finish  
coat

Drying Time

Dry-To-Touch

Dry Hard

Other

Fresh water resistance: no  
blistering, softening or  
rusting  
Thermal Shock: no evidence  
of blistering or flaking  
after treatmentFresh water resistance: no  
blistering, softening or  
rusting  
Thermal Shock: no evidence  
of blistering or flaking  
after treatment

## SECTION D

27

28

## Specification

Iowa DOT 4182.02

Ohio Supplement 950

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No loss of bond, blistering,  
or rusting beyond scribe  
lines after 1,000 hrsNo loss of bond, blister-  
ing, or rusting beyond  
scribe lines after  
1,000 hrs

## Adhesion

## Weathering

No loss of bond, blister-  
ing or rusting after 1,000  
hrs

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Resistance to elevated  
temperature and thermal  
shock: no blistering  
or flaking after treat-  
mentFresh water resistance:  
no rusting, blistering  
or softening after 30  
days

Salt water resistance

Resistance to elevated  
temperature and thermal  
shock: no blistering  
or flaking after treat-  
mentFresh water resistance:  
no rusting, blistering  
or softening after 30  
days

Salt water resistance



SECTION D

29

Specification

Ohio Supplement  
950 (Single Component)

Requirements

Qualified  
Products  
List (?)

Salt Spray

No loss of bond, blistering, or rusting beyond scribe lines after 1,000 hrs

Adhesion

Weathering

No loss of bond, blistering or rusting after 1,000 hrs

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Resistance to elevated temperature and thermal shock: no blistering or flaking after treatment

Fresh water resistance: no rusting, blistering or softening after 30 days

Salt water resistance

## SECTION D

30

31

## Specification

Florida DOT 971.14

Canadian Gov't.  
Specifications Board  
CGSB 1-GP 171c, Type I

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No corrosion after 1,000 hr

No corrosion of blistering  
beyond scribe lines after  
720 hours

## Adhesion

No loss of adhesion

## Weathering

## Color

## Drying Time

## Dry-To-Touch

## Dry Hard

## Other

Abrasion resistance:  
maximum loss of 0.2 grams  
per thousand cycles with  
CS-17 wheels and 1,000  
gram load per wheelFlash point: 95 F  
Coarse particles: 0.57%  
(max)  
Immersion test: no soften-  
ing or loss of adhesion

## SECTION D

32

33

## Specification

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Drying Time

Dry-To-Touch

Dry Hard

Other

Canadian Gov't.  
Specifications Board  
CGSB 1-GP-171c  
Type IINo corrosion or blistering  
beyond scribe lines after  
720 hoursSteel Structures  
Painting Council  
SSPC X 20X Type INo rusting, blistering of  
undercutting of coating  
after 1,000 hours  
No loss of film adhesionFlash point: 95 F  
Coarse particles: 0.57%  
(max)  
Immersion test: no soften-  
ing or loss of adhesionViscosity: within  $\pm 5$   
Krebs' units of previously  
qualified paints  
Weight per gallon: within  
 $\pm 4$  lb of previously  
qualified paints  
Solids: within  $\pm 2\%$  of  
previously qualified paint

## SECTION D

34

35

## Specification

Steel Structures ..  
Painting Council  
SSPC X 20X Type II

Ameron Dimetecote E2

## Requirements

Qualified  
Products  
List (?)

## Salt Spray

No rusting, blistering of  
undercutting of coating  
after 1,000 hours

## Adhesion

No loss of film adhesion

## Weathering

## Color

## Drying Time

## Dry-To-Touch

15-20 min

## Dry Hard

15 min

## Other

Viscosity: within  $\pm 5$   
Krebs' units of previously  
qualified paints  
Weight per gallon: within  
 $\pm 4$  lb of previously  
qualified paints  
Solids: within  $\pm 2\%$  of  
previously qualified paint

Flash point: 77 F

## SECTION D

36

37

## Specification

Ameron Dimetecote  
EZ IIAmeron Dimetecote Steel  
Primer 1M

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

## Drying Time

Dry-To-Touch

5 min

4-10 min

Dry Hard

15 min

24 hr

Other

Flash point: 80 F

Flash point: 70 F

## SECTION D

38

39

## Specification

Ameron Dimetcote  
Steel Primer 2

Ameron Dimetcote 3

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

## Drying Time

Dry-To-Touch

15 min

2-4 hr

Dry Hard

## Other

Flash point:  
nonflammable  
Pot life: 8 hr  
70 FFlash point: 8 F  
Pot life: 8 hr 70 F

SECTION D

40

41

Specification

Ameron Dimetecote 4

Ameron Dimetecote 4  
Food Grade

Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Drying Time

Dry-To-Touch

30 min

Dry Hard

24 hr

Other

Color change from  
blue to gray  
Pot life: 8 hr at  
70 F  
Flash point: non-  
flammable

Pot life: 72 hours  
at 70 F  
Flashpoint: non-  
flammable

## SECTION D

42

43

## Specification

Ameron Dimetecote 5

Ameron Dimetecote 6

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

## Drying Time

Dry-To-Touch

one hr

fifteen min

Dry Hard

24 hr

24 hr

Other

Pot life: 8 hr  
at 70 F with con-  
tinuous agitation  
Flash point: non-  
flammablePot life: 24 hr at 70 F  
Flash point: 77 F



## SECTION D

44

45

## Specification

Ameron Dimetecote 8

Ameron Dimetecote 9

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

Matte gray

## Drying Time

Dry-To-Touch

two hr at 70 F

18 min at 77 F

Dry Hard

twenty-four hr (min)

Other

Pot life: 8 hr at 70 F  
Flash point: 8 FPot life: 24 hr at 77 F  
Flash point: 58 F

## SECTION D

46

47

## Specification

Ameron Dimetecote 9FT

Ameron Dimetecote 10

## Requirements

Qualified  
Products  
List (?)

Salt Spray

Adhesion

Weathering

Color

## Drying Time

Dry-To-Touch

one hr at 70 F

Dry Hard

18 min at 77 F

24 hr at 70 F

Other

Pot life: 72 hr at 77 F  
Flash point: 59 F

Pot life: 72 hr at 70 F  
Flash point: non-  
flammable

SECTION D

48

Specification	Carboline Company Revised Specification Painting Existing Steel Bridge Structures
Requirements	
Qualified Products List (?)	
Salt Spray	No rusting, blistering or corrosion beyond 1/16" from center of scribe line after 1,000 hours
Adhesion	
Weathering	No rust corrosion or blistering after 1,000 hours
Color	
Drying Time	
Dry-To-Touch	
Dry Hard	
Other	Fresh water resistance: no rusting, blistering or softening after 30 days Salt water resistance: no rusting, blistering or softening after 30 days

SECTION E

Packing, Packaging, and Marking

SECTION E

1

2

Specification

DOD-P-21035A  
(Navy)

MIL-P-23236  
(Ships) Class III

Packing

PPP-P-1892, level  
A, B or C

TT-P-143, level A, B or C  
in one or five gallon cans.

Packaging

PPP-P-1892 level A  
or C

TT-P-143 level A or C

Marking

As required by contract  
or order with notice of  
photochemical re-  
activity IAW South  
Coast Air Quality Mgt.  
rule 102

As required by contract and  
in accordance with MIL-L-19868  
Class 1 or 2.

SECTION E

	3	4
Specification	MIL-P-38336 (USAF)	MIL-P-19453A (Ships) Class I
Packing	TT-P-143, Level A, B or C	TT-P-143 Level A, B or C in separate containers
Packaging	TT-P-143 Level A or C	TT-P-143, Level A or C
Marking	MIL-STD-129	MIL-STD-755, Class 2, plus any special marking specified in contract or order.

## SECTION E

5

6

Specification

MIL-P-19453A  
(Ships) Class IIMIL-P-26915A  
Class A

Packing

TT-P-143 Level A, B or  
C in separate containers

TT-P-143 level A, B or C

Packaging

TT-P-143, Level A or C

TT-P-143 level A or C

Marking

MIL-STD-755, Class 2,  
plus any special marking  
specified in contract  
or order.

MIL-STD-129

SECTION E

7

8

Specification

MIL-P-26915A  
Class B

MIL-P-15145B

Packing

TT-P-143 level A, B or C

TT-P-143, level A, B, or C

Packaging

TT-P-143 level A or C

TT-P-143, level A or C

Marking

MIL-STD-129

TT-P-143 and contractual  
specifications



SECTION E

9

10

Specification

NASA/KSC F-0008  
Type I, Class I

NASA/KSC F-0008  
Type I, Class II

Packing

Manufacturer's commercial  
practice in one-gallon  
cans

Manufacturer's commercial  
practice in one-gallon  
cans

Packaging

Manufacturer's commercial  
practice

Manufacturer's commercial  
practice

Marking

SECTION E

11

12

Specification:

KSC F-0008  
Type II, Class I

KSC F-0008  
Type II, Class II

Packing:

Manufacturer's commercial  
practice in one-gallon  
cans

Manufacturer's commercial  
practice in one-gallon  
cans

Packaging:

Manufacturer's commercial  
practice

Manufacturer's commercial  
practice

Labelling:

SECTION E

13

14

Specification

TT-P-641G  
Type I

TT-P-641G  
Type II

Packing

PPP-C-96, type V or  
PPP-P-704, type  
III  
PPP-B-601, PPP-B-621,  
Class II, PPP-B-636  
(weather resistant)  
or PPP-B-640, Class I

PPP-C-96, type V or  
PPP-P-704, type  
III  
PPP-B-601, PPP-B-621,  
Class II, PPP-B-636  
(weather resistant)  
or PPP-B-640, Class I

Packaging

Labelling

Civil Agencies: FED  
STD 123  
Military Agencies:  
MIL STD 129

Civil Agencies: FED  
STD 123  
Military Agencies:  
MIL STD 129

SECTION E

15

16

Specification

TT-P-641G  
Type III

AASHTO Proposed Revision  
Painting Metal Structures,  
Sec. 14 (Inorganic)

Packing

PPP-C-96, type V or  
PPP-P-704, type III  
PPP-B-601, PPP-B-621,  
Class II, PPP-B-636  
(weather resistant)  
or PPP-B-640, Class I

Separate equal containers  
treated to prevent attack  
by components

Packaging

Marking

Civil Agencies: FED  
STD 123  
Military Agencies:  
MIL STD 129

Complete instructions for  
use and precautionary  
information

SECTION E

17

18

Specification

AASHTO Proposed  
Revision Painting  
Metal Structures,  
Sec. 14 (Organic)

California  
DOT 681-80-51

Packing

Separate equal containers  
treated to prevent attack  
by components

Packaging

Marking

Complete instructions for  
use and precautionary  
information

SECTION E

19

20

Specification

California  
DOT 681-80-56

California  
DOT 741-80-62

Packing

One unit of pigment  
to one unit of vehicle  
to be mixed 1:1

One unit of pigment  
to one unit of vehicle  
to be mixed 1:1

Packaging

Marking

To show manufacturer's  
name, state specifica-  
tion number, lot or  
batch number, date of  
manufacture, date of  
packaging, expiration  
date, (if any) and  
complete instructions  
for use

To show manufacturer's  
name, state specifica-  
tion number, lot or  
batch number, date of  
manufacture, date of  
packaging, expiration  
date, (if any) and  
complete instructions  
for use

SECTION E

21

22

Specification

California  
DOT 701-80-52

California  
DOT 8010-61J-36

Packing

One unit of vehicle  
to be packed with one  
unit of pigment to  
form paint in 1:1 mix

Packaging

Marking

To show manufacturer's  
name, state specifica-  
tion number, lot or  
batch number, date of  
manufacture, date of  
packaging, expiration  
date, (if any) and  
complete instructions  
for use

SECTION E

23

24

Specification

North Carolina DOT  
8.1558304 (Two-  
Component)

North Carolina DOT  
8.1558304 (Single  
Component)

Packing

Packaging

Marking



SECTION E

25

26

Specification

Indiana DOT Painting  
Structural Steel,  
sec. V-A

Indiana DOT Painting  
Structural Steel,  
sec.V-B

Packing

One unit of each such that  
1:1 mix produces proper  
paint formula

One unit of each such that  
1:1 mix produces proper  
paint formula

Packaging

In new containers of such  
design and material that  
the paint will be protected  
in transit and storage

In new containers of such  
design and material that  
the paint will be protected  
in transit and storage

Marking

Manufacturer's name, brand  
name, date of manufacture,  
net volume, and complete  
instructions

Manufacturer's name, brand  
name, date of manufacture,  
net volume, and complete  
instructions

## SECTION E

27

28

## Specification

Iowa DOT 4182.02

Ohio Supplement 950

## Packing

So that one unit of vehicle  
may be mixed with one unit  
of pigment to form paint

So that one unit of vehicle  
may be mixed with one unit  
of pigment to form paint

## Packaging

New metal cans or pails  
coated to prevent attack  
by paint or components

New metal cans or pails  
coated to prevent attack  
by paint or components

## Marking

Manufacturer's name, brand  
name, net weight, lot  
number, date of manufacture  
and complete instructions

Manufacturer's name, brand  
name, net weight, lot  
number, date of manufacture  
and complete instructions

SECTION E

29

Specification

Ohio Supplement  
950 (Single Component)

Packing

So that one unit of vehicle  
may be mixed with one unit  
of pigment to form paint

Packaging

New metal cans or pails  
coated to prevent attack  
by paint or components

Marking

Manufacturer's name, brand  
name, net weight, lot  
number, date of manufacture  
and complete instructions

SECTION E

30

31

Specification

Florida DOT 971.14

Canadian Gov't.

Specifications Board

CGSB 1-GP 171c, Type I

Packing

No more than one gallon in  
a single container

Commercial packing, packaging  
and marking acceptable  
unless otherwise specified

Packaging

1 gallon or less: commercial  
packaging  
Over 1 gallon: 26 gage  
steel pails

Marking

Manufacturer's name, brand  
name, CGSB standard number,  
type and class, qualification  
number, batch number, code  
number, date of manufacture  
and instructions for use  
and precautions

## Specification

## Packing

Canadian Gov't.  
Specifications Board  
CGSB 1-GP-171c  
Type II

Commercial packing, packaging  
and marking acceptable  
unless otherwise specified

Steel Structures  
Painting Council  
SSPC X 20X Type I

## Packaging

## Marking

Manufacturer's name, brand  
name, CGSB standard number,  
type and class, qualification  
number, hatch number, code  
number, date of manufacture  
and instructions for use  
and precautions

SECTION E

34

35

Specification

Steel Structures  
Painting Council  
SSPC X 20X Type II

Ameron Dimetecote EZ

Packing

Packaging

Marking

SECTION E

36

37

Specification

Ameron Dimetecote  
EZ II

Ameron Dimetecote Steel  
Primer 1M

Packing

Packaging

Marking

PAGE E-21, Omitted, for  
information, Contact:

ANERON DIMETCOTE-3  
Corrosion Div.,  
Brea, CA 92861

[E-21]



SECTION E

40

41

Specification

Ameron Dimetecote 4

Ameron Dimetecote 4  
Food Grade

Packing

Packaging

Marking

SECTION E

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Specification

Ameron Dimetcote 5

Ameron Dimetcote 6

Packing

Packaging

Marking

SECTION E

44

45

Specification

Ameron Dimetecote 8

Ameron Dimetecote 9

Labeling

Labeling

Marking

SECTION E

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Specification

Ameron Dimetecote 9FT

Ameron Dimetecote .10

Packing

Packaging

Marking

SECTION E

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Specification	Carboline Company Revised Specification <u>Painting</u> Existing <u>Steel Bridge</u> Packing <u>Structures</u>
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Packaging	In single container
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Marking	Name of manufacturer, lot number, date of manufacture and complete instructions for use
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SECTION F

Abstracts of Reports Supplied by  
Defense Documentation Center

AD- 759 683 11/3  
NAVAL CIVIL ENGINEERING LAB PORT HUENEME CALIF

Zinc-Rich Organic Systems Exposed Five  
Years to a Marine Atmosphere.

(U)

DESCRIPTIVE NOTE: Final technical rept. 1967-1972,  
MAR 73 62P Brouillette, Carl V. ;  
REPT. NO. NCEL-TR-784  
PROJ: YF51.543  
TASK: YF51.543.006

UNCLASSIFIED REPORT

DESCRIPTORS: (\*PAINT PRIMERS, \*CORROSION INHIBITION),  
(\*ZINC, PAINT PRIMERS), ADDITIVES, SEA WATER,  
ENVIRONMENTAL TESTS, TABLES(DATA) (U)  
IDENTIFIERS: SEA WATER CORROSION (U)

Zinc-rich organic primers, with and without topcoats, were exposed for 5 years in the tropical marine atmospheric environment of Kwajalein, Marshall Islands, and Kaneohe, Hawaii, and at Port Hueneme, California. Satisfactory protection to steel test panels was given by two- and three-package zinc-rich epoxy primers, and a zinc-filled modified saran coating. An alkyd enamel was found to be a very good topcoat when applied directly over the zinc-rich primer. A silicone alkyd was found to give outstanding protection as a topcoat. A modified saran containing 3.1 to 5.3 pounds of zinc dust per gallon, with or without a modified saran topcoat, gave excellent protection to the steel test specimens. Zinc-rich epoxy primers are recommended for replacing primers containing toxic lead oxide or chromate pigmentation. The degree of protection of metal substrates by coating systems exposed to severe tropical marine atmospheric environments for 3 to 5 years can be used as the criterion for predicting good to superior performance by coatings. (Author Modified Abstract) (U)

AD- 803 682 11/3  
NAVAL CIVIL ENGINEERING LAB PORT HUENEME CALIF

Zinc Rich Organic Coating Systems Exposed  
to a Marine Atmosphere: Three-year Exposure  
of Zinc Rich Saron.

(U)

DESCRIPTIVE NOTE: Technical note Oct 66-Oct 69,  
MAR 71 22P Brouillette, Carl V. ;  
REPT. NO. NCEL-TN-1092-Suppl  
PROJ: YF51.543.006.01.0088

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Supplement to report dated May 70,  
AD-871 186L.

DESCRIPTORS: (\*PLASTIC PAINTS, \*CORROSION INHIBITORS),  
ZINC, PARTICLES, HALOCARBON PLASTICS, PLASTIC PAINTS,  
ENVIRONMENTAL TESTS, PARTICLE SIZE, ADDITIVES,  
SILICONES, STEEL, EPOXY RESINS, WEATHERPROOFING, ORGANIC  
COATINGS

(U)

IDENTIFIERS: ALKYD RESINS, FILLED THERMOPLASTICS,  
PROTECTIVE COATINGS, VINYLIDENE CHLORIDE RESINS,  
WEATHERING

(U)

Three-package or two-package zinc-rich epoxy  
coatings, with or without topcoats, and a zinc-filled  
modified saron (5.3 pounds of zinc per gallon),  
with or without a modified saron topcoat, will give  
long term protection to steel in a marine atmosphere  
environment. (Author)

(U)

AD- 874 397L 11/3 11/9  
ARMY COATING AND CHEMICAL LAB ABERDEEN PROVING GROUND  
MD

A Study of Zinc-Rich Primers.

(U)

DESCRIPTIVE NOTE: Final rept.,  
AUG 70 73P Thompson, Joseph H. ;  
REPT. NO. CCL-283  
PROJ: DA-1-G-062105-A-329

UNCLASSIFIED REPORT

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Aberdeen Proving Ground, Md. 21005.

DESCRIPTORS: (\*PAINT PRIMERS, ZINC), FILMS, SUBSTRATES,  
SPRAYS, BINDERS, AGING(MATERIALS), IMPACT SHOCK, SALT  
SPRAY TESTS, TROPICAL TESTS, DEGRADATION, EPOXY RESINS,  
POLYAMIDE PLASTICS, ESTERS, HYDROCARBONS, SODIUM  
COMPOUNDS, POTASSIUM COMPOUNDS, COPOLYMERIZATION,  
AMMONIUM COMPOUNDS, COLLOIDS, SILICATES, CHLORINATION,  
BUTADIENES, STYRENE PLASTICS, PHENOLS, PHENOLIC  
PLASTICS

(U)



AD- 905 719 11/3 11/6  
NAVAL CIVIL ENGINEERING LAB PORT HUENEME CALIF

Zinc Inorganic Silicate Coatings: Five  
Years Marine Atmospheric Exposure. (U)

DESCRIPTIVE NOTE: Final rept.,  
NOV 72 72P Brouillette, Carl V. ;Curry,  
A. F. ;  
REPT. NO. NCEL-TR-776  
PROJ: YF54-543  
TASK: YF54-543-006

UNCLASSIFIED REPORT

DESCRIPTORS: (\*PAINT PRIMERS, ENVIRONMENTAL TESTS),  
(\*PAINTS, STEEL), PROTECTIVE TREATMENTS, ZINC COMPOUNDS,  
SILICATES, WEATHERPROOFING, SALT SPRAY TESTS, EPOXY  
RESINS, PLASTIC PAINTS, VINYL PLASTICS, POLYESTER  
PLASTICS, OILS, CORROSION, CURING AGENTS, KWAJALEIN  
ATOLL, CALIFORNIA, HAWAII (U)  
IDENTIFIERS: \*ZINC SILICATE (U)

Ten zinc inorganic silicate coatings were exposed  
for 5 years at the three atmospheric environmental  
test sites of the Naval Civil Engineering  
Laboratory. These test sites are Kwajalein,  
Marshall Islands; Kaneohe, Hawaii (both  
tropical environments); and Port Hueneme,  
California. The zinc inorganic silicate coatings  
were exposed with and without topcoats. It was  
found, that in general, postcuring and superior self-  
curing zinc inorganic silicate coatings without  
topcoats will give long-term protection to steel. A  
compatible topcoat will improve the protective  
properties, especially of an inferior zinc inorganic  
silicate coating. Compatible vinyl, epoxy, or alkyd  
coatings are effective topcoats for the zinc  
inorganic silicate coatings. (U)

AD- 912 163L 11/3 13/10  
MARE ISLAND NAVAL SHIPYARD VALLEJO CALIF PAINT LAB

Development of Zinc Containing Epoxy-  
Polyamide Coating for Ship Interior and  
Exterior Steel Surfaces. (U)

DESCRIPTIVE NOTE: Technical rept.,  
DEC 72 52P Neal, Jesse R. ;Salmas,  
Thelma A. ;  
REPT. NO. 72-3  
PROJ: SF54-544  
TASK: SF54-544-602

UNCLASSIFIED REPORT

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Hyattsville, MD. 20782.

SUPPLEMENTARY NOTE: Original contains color plates:  
All DOC reproductions will be in black and white.

DESCRIPTORS: (\*PAINT PRIMERS, SHIP STRUCTURAL  
COMPONENTS), ZINC COMPOUNDS, PIGMENTS, EPOXY RESINS,  
POLYAMIDE PLASTICS, PLASTIC PAINTS, TOUGHNESS,  
ENVIRONMENTAL TESTS, CATHODIC PROTECTION, SHIP HULLS,  
STEEL, SURFACES, METAL COATINGS, BINDERS,  
SPECIFICATIONS (U)

## SECTION G

### National Government Specifications

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John F. Kennedy Space Center, NASA Specification F-0008 . . . . .	G - 77
MIL-P-26915A (USAF) . . . . .	G - 87
MIL-P-19453A (Ships) with Amendment 1 . . . . .	G - 109
MIL-P-38336 (USAF) with Amendment 1 . . . . .	G - 118
MIL-P-23236 (Ships) . . . . .	G - 133
DOD-P-21035A (Navy) . . . . .	G - 156
NASA/Technology Utilization Office . . . . .	G - 163

**Standard Specifications  
for Construction of  
Roads and Bridges on  
Federal Highway Projects**

**FP-79  
1979**

**U.S. DEPARTMENT  
OF TRANSPORTATION  
Federal Highway Administration**

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Washington, D.C. 20402  
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53.2

(3) Finish coat shall be the same as the prime coat but tinted to National Park Service green or gray as specified in the contract.

(f) System 5 Organic Zinc-rich Paint System.

(1) Prime coat shall conform to the following requirements:

Description:

This specification covers a one-package, thermoplastic organic zinc-rich primer whose mechanism of drying is that of solvent release. It is intended for use only on blast cleaned open steel structures exposed to the air.

Composition:

Pigment Ingredients  
(62.3 Percent of Composition Weight, Minimum)

Specification	Parts by Weight of Pigment	
	Type I, Red Tint	Type II, Gray
Zinc Dust	ARTM D 528	94.0 min
Red Iron Oxide <sup>1</sup>	—	1.5 max
Zinc Oxide	TT-P-463, Type I, Grades A or B	—
Tin, antimony and additives	—	2.5 max

Vehicle Ingredients

(21.7 Percent of Composition Weight, Minimum)

Specification	Parts by Weight of Vehicle	
	Type I, Red Tint	Type II, Gray
Polyvinyl Ether <sup>1</sup>	—	19.0
Ethylene Glycol Monoethyl Ether Acetate	ML-E-112A	96.5
Toluene	TT-T-648	14.2

<sup>1</sup> Except the metallic zinc content shall be 86 percent by weight.

<sup>2</sup> For 10 mils, minimum, of absorption, 21, (measured through 225 mesh screen, 99% minimum, and specific gravity, 5.14).

<sup>3</sup> A polyethylene polybutyl polyester of the following properties:

Specific gravity	1.18
Viscosity of 4% solution in methyl ethyl ketone, Brookfield RVF, 20 rpm No. 5 spindle	5,500 to 7,700 cps
Revised viscosity 10.2 g (100 ml, diethylacetamide)	0.4 to 0.8
Tensile ultimate strength	9,100 to 9,500 psi
Tensile ultimate elongation	60 to 100%
Tensile ultimate modulus	112 P
Flowing time pressure	3.50 lbs per gal

The average particle size of the pigment shall not exceed 9 microns as determined by the Fisher Sub-Sieve Sizer. The Red Iron Oxide must first be ground into a portion of the vehicle to provide a Hefman grind sufficient to produce the specified color of the finished paint. The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

Infrared Characteristic Curve of Primer Vehicle:

When dried upon a potassium bromide disc, a film of the primer shall have infrared absorption maxima at the same wavelengths and to the same relative degree as that shown by the curve on file in the PHSWA Laboratory.

The composition of the extracted zinc dust pigment shall match the X-ray diffraction curve on file at the Laboratory.

The paint shall in addition to the preceding composition conform to the following table of requirements:

Characteristics of Paint:

Volatiles at 105°C., percent by weight	26-22
Weight per gallon, pounds	17.2-18.0
Viscosity, KU at 77°F.	160-120
Metallic zinc, percent by weight of extracted pigment by Federal Test Method N 141, Method 7221	90.2 min
Dry time at 77°F., 50% relative humidity, 6 mil wet thickness:	
Set to touch, hours	¼ max
Dry hard, hours	5 max
Storage life, years	1 min

Properties of Cured Coating:

When applied to a plate glass panel with a 6 mil gap clearance doctor blade and cured for 15 days at 77° ± 5°F. and 50 ± 5% relative humidity, the coating shall have the following properties:

Pencil Hardness	B min
Color (for Type I only)	Not Lighter Than Federal Standard Color 31575

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on blast cleaned steel having an anchor profile pattern of one to 1.5 mils the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging. When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-658, the panel being previously cleaned by blast cleaning to produce a one to 1.5 mil anchor pattern, and cured for 15 days at a relative humidity of 50 ± 5% and tested according to the Conical Mandril Test, Federal Test Method standard No. 141, Method 6222, there shall be no loosening of the film above the point of the longest continuous crack. When a steel panel is blast cleaned to white metal and coated with 3-4 mils dry film thickness of this coating and cured for 15 days at 75 ± 2°F. and 50 ± 5% relative humidity and diagonally scribed to expose base steel, there shall be no underfilm corrosion on the surface of the panel extending beyond the scribed lines after 1,000 hours when tested according to ASTM B-117.

Prior to use, the paint shall be thinned with not more than one volume of thinner to 4 volumes of paint using a power agitated stirrer. The thinner shall consist of a mixture of 82 percent by volume of ethylene glycol monethyl ether acetate and 18 percent by volume of toluene.

(2) Intermediate coat shall be the same as the prime coat tinted to contrast with both the prime coat and the vinyl wash coat.

(3) Vinyl wash the coat shall conform to MIL-P-15328.

(4) Finish coat shall conform to SSPC-A-64 or 9-64 or TT-P-615 with the color as specified in the contract.

(g) Sampling and testing—Unless otherwise specified, sampling will be performed in accordance with method 1021, Federal Test Method No. 141.

The paint will be tested in accordance with methods of Federal Test Method Standard No 141, as follows:

Test:	Method
Percentage of pigment	4021
Isolation of vehicle	4032
Non-volatile in vehicle	14053

<sup>1</sup> A gravity separation test may be used to determine the non-volatile content of the unpolymerized vehicle if the procedure is outlined in Method 4041 as modified in Federal Test Method 4032. Weigh approximately 100 g of sample (by difference), then (for one hour, coat and weight) (for two hours, allow to sediment the percentage of non-volatile and stir.

Test	Method
Pulverize anhydride	71021
Uncombined water	41061 or 41062
Consistency, Krebs-Stormer	42061
Coarse particles and skins	41061
Weight per gallon	41164
Set to touch time	41063
Condition in container	30111
Brushing properties	2141, 43321
Skimming	30621
Roam and resin derivatives	21031
Storage stability	20622
Dry through time	41061
Fineness of grind	43111

<sup>1</sup> Make use test on a portion of the loaded volume.

## Section 709.—REINFORCING STEEL AND WIRE ROPE

709.01 Reinforcing steel. Reinforcing steel shall conform to the requirements of the following AASHTO specifications:

Deformed Billet-Steel Bars for Concrete Reinforcement	AASHTO M 31 (ASTM A 616)
Deformed Steel Wire for Concrete Reinforcement	AASHTO M 225 (ASTM A 496)
Welded Steel Wire Fabric for Concrete Reinforcement	AASHTO M 55 (ASTM A 185)
Cold-Drawn Steel Wire for Concrete Reinforcement	AASHTO M 32 (ASTM A 82)
Welded Deformed Steel Wire Fabric for Concrete Reinforcement	AASHTO M 221 (ASTM A 497)
Fabricated steel bar or rod made for concrete reinforcement	AASHTO M 54 (ASTM A 184)
Welded steel wire fabric for concrete reinforcement	AASHTO M 55 (ASTM A 185)
Welded deformed steel wire fabric for concrete reinforcement	AASHTO M 221 (ASTM A 497)
Plastic coated dowel bars	AASHTO M 254, Type A
Low alloy steel deformed bars for concrete reinforcement	ASTM A 206

Bar reinforcement for concrete structures, except No. 2 bars, shall be deformed in accordance with AASHTO M 42, M 31 and M 63 for Nos. 3 through 11.

Dowel and tie bars shall conform to the requirements of AASHTO M 31 or M 42 except that rail steel shall not be used for the bars that are to be bent and restrengthened during construction. Tie bars shall be deformed bars. Dowel bars shall be plain round bars. They shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the site of the work, a minimum  $\frac{1}{2}$  the length of each dowel bar shall be painted with one coat of approved lead or tar paint.

The sleeves for dowel bars shall be metal of an approved design to cover 2 inches, plus or minus  $\frac{1}{4}$  inch of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 1 inch from the end of the dowel bar. Sleeves shall be of such design that they do not collapse during construction.

Plastic coated dowel bar conforming to AASHTO M 254 may be used.

709.02 Wire Rope or Wire Cable. The wire rope or wire cable shall conform to the requirements of AASHTO M 30 for the specified diameter and strength class.

709.03 Prestressing Reinforcing Steel. Prestressing reinforcing steel shall be high-tensile wire conforming to AASHTO M 204 (ASTM A-421) high-tensile wire strand or rope conforming to AASHTO M 203 or high-tensile alloy bars as follows:

High-tensile-strength alloy bars shall be cold stretched to a minimum of 1,200,000 psi. The resultant physical properties shall be as follows:

Minimum ultimate tensile strength	145,000 psi followed by stress relieving
Minimum yield strength, measured by the 0.7 percent extension under load method shall be not less than	130,000 psi
Minimum modulus of elasticity	29,000,000 psi
Minimum elongation in 20 bar diameters after rupture	4 percent
Diameter tolerance	+0.003"—0.001"

If shown on the plans, type 270k strand shall be used, conforming to AASHTO M 203

## Section 710.—FENCE AND GUARD RAIL

710.01 Barbed Wire. Galvanized barbed wire of the coating class specified, shall conform to the requirements of ASTM A121. Aluminum coated barbed wire shall conform to the requirements of ASTM A595, with Type I (Aluminum Coated) or Type II (Aluminum Alloy) barbs at the option of the manufacturer.

710.02 Woven Wire. Galvanized woven wire fence of the coating class specified shall conform to the requirements of ASTM A116. Aluminum coated woven wire fence shall conform to the requirements of ASTM A594.

710.03 Chain Link Fence. Chain link fabric and the required fittings and hardware shall conform to the requirements of AASHTO M141, for the kind of metal coating, size of wire, and mesh specified. Galvanized coiled spring steel tension wire shall be 7 (1.77) gauge, conforming to ASTM A641, hard temper, with Class 3 coating unless otherwise specified or shown on the drawings.

Aluminized coil spring steel tension wire shall also be 7 (1.77) gauge, hard temper, having a minimum coating weight of 40 ounces per square foot of aluminum.

710.04 Metal Beam Rail. Steel rail elements shall be corrugated sheet steel beams conforming to the requirements of AASHTO M149 of the designated class and type.

710.05 Timber Rail. The timber rail shall be cut from the specified grade of dry, well seasoned and dressed timber stock of the species specified, which shall meet the applicable requirements of AASHTO M168.

Where preservative treatment is specified this shall conform to the requirements of subsection 716.03.

Rustic rails shall be straight, sound, and free of injurious defects and shall have been cut from live trees not less than 30 days but not more than 1 year before use. They shall have been stripped of bark before seasoning or shall have been stored under water. Immediately before the logs are used in the work all knots and projections shall be trimmed smooth and, if water cured, all bark shall be peeled. Slight curvature or "wind" to give a pleasing appearance to the structure will be permitted. Logs of only one species shall be used in the construction of any one continuous length of guardrail.

710.06 Fence Posts. Wood posts shall conform to the details and dimensions indicated on the plans. All wood posts shall be of sound, seasoned wood, peeled and with ends cut square or as indicated. The posts shall be straight and all knots trimmed flush with the surface. Where treated posts are called for, the kind and type of treatment shall conform to that indicated on the plans. When red cedar posts or bracing is furnished, the requirements for peeling may be omitted.

All dimension timber and lumber required for fences or gates shall be sound, straight and reasonably free from knots, splits and shakes. It shall be of the species and grades indicated on the plans and shall be dressed and finished on four sides.

Concrete posts shall be made of concrete conforming to section 612 for the class specified.

Except as otherwise required in the cited specifications, all paint shall meet the following general requirements.

- (1) The paint shall not show excessive settling in a freshly-opened full can, and shall not be redispersed with a paddle to a smooth, homogeneous state. The paint shall show no cracking, blistering, causing on color separation, and shall be free from lumps and skins.
  - (2) The paint as received shall brush easily, produce good leveling properties, and show no running or sagging tendencies when applied to smooth, steel vertical surfaces.
  - (3) The paint shall not skin within 48 hours in a three-quarters filled closed container.
  - (4) The paint shall dry to a smooth uniform finish, free from roughness, grit, unevenness, and other surface imperfections. The paint shall show no streaking or separation when flowed on clean glass.
  - (5) The paint shall show no thickening, curdling, gelling, or hard caking after six months storage in a full, tightly-covered container at a temperature of 70°F.
- (b) System 1 - Vinyl Paint System
    - (1) Vinyl wash primer shall conform to Mil-P-15329.
    - (2) Vinyl intermediate coat shall conform to Mil-P-15929, Mil-P-15830, or SSPC-8-64 or 9-64.
    - (3) Third and fourth coat shall be the same as the intermediate coat.
    - (4) Finish coat shall be the same as the intermediate coat or SSPC-8-64 or 9-64 or TT-P-615 to obtain the desired finish color.
  - (c) System 2 - Epoxy-Polyamide Paint System.
    - (1) Primer coat shall conform to Mil-P-2441, Formula 150 and the color as specified.
    - (2) Intermediate coat and third coat shall conform to Mil-P-2441, using contrasting color sequences.
    - (3) Finish coat shall conform to SSPC-8-64 or 9-64 or TT-P-615 to obtain the desired finish coat, and shall be applied in accordance with the recommendations of the manufacturer of the undercoat. It is recommended that the entire paint system be supplied by the same manufacturer.
    - (d) System 3 - Inorganic Zinc Silicate System.
      - (1) Prime coat. Inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed, cures without the use of a separate curing solution, and shall have the properties described herein.

Pigment. The zinc pigment component shall comply with the requirements of ASTM D620 or Type II. The average particle size of the zinc powder shall not exceed 10 microns as determined by the Fisher Sub-sieve sizer.

Vehicle. The vehicle component shall consist primarily of an alkyl silicate in an appropriate alcohol solvent. Total solids, by content shall be determined by drying the sample to a constant weight at 100°C.

a. Mixed Paint. Mixed paint shall conform to the following requirements:

1. The zinc portion shall be at least 75 percent by weight of the total solids of the dried coating.
  2. The total solids, when heated at 100°C for 3 hours, shall be not less than 72 percent by weight.
  3. The paint shall tolerate up to one percent water contamination without gelation.
  4. The wash pot life of the mixed paint shall be not less than 12 hours at 77°F. There shall be no hard settling which cannot be easily redispersed during this period.
  5. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the topcoat.
- Resistance Tests. Test panels of steel meeting the requirements of ASTM D699 having dimensions of 2 by 5 inches by 1/4 inch, shall be prepared by cleaning all surfaces to the same degree specified under Spec. 555-22. A 3-4 mil coating (dry thickness) shall then be applied to the test panels in accordance with the manufacturer's current printed instruction. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be

performed on a minimum of three panels. The material will not be accepted if any individual test panel fails any of the following tests:

1. Fresh Water Resistance. Panels shall be soaked during to loose metal with an X of at least 2-inch legs and shall be immersed in fresh tap water at 70° ± 5°F. The panels shall show no rusting, blistering, or softening when examined after 30 days.
  2. Salt Water Resistance. Panels shall be soaked down to loose metal with an X of at least 2-inch legs and immersed in 5 percent sodium chloride at 70° ± 5 at 7, 14 and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.
  3. Weathering Resistance. Panels shall be tested in accordance with ASTM G23, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel, or blistering.
  4. Weather and Salt Fog Resistance. Panels shall be tested in the weatherometer as specified in c. for 300 hours. After this period the panels shall be removed and scrubbed with an X of at least 2-inch legs down to bare metal. The test panels shall then be tested in accordance with ASTM B117. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the active mark.
  5. Resistance to Elevated Temperatures and Thermal Shock. Panels shall be exposed to a temperature of 500°F for one hour, then quenched immediately in 60° ± 5°F water. Panels subjected to this test shall show no blistering or flaking of the coating.
  6. Adhesion tests shall be tested in accordance with ASTM D-3-509 and shall attain a rating of 2 or greater.
  7. Mud Cracking Resistance. The coating when applied to test panels as above to a 5 to 6 mil dry film thickness shall show no mud cracking when viewed under 10-X magnification.
- Manufacturer and Brand Name Approval for Inorganic Zinc Primer. Prior to approval and use of inorganic zinc, the contractor shall submit in triplicate to the Engineer a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative and resistance test requirements of these specifications. The certified test report shall also contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the Engineer of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of 2 years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed, and may be required by the Engineer when sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.
- (2) Intermediate epoxy-polyamide coat shall be applied as recommended by the manufacturer in a single application employing multiple spray passes. The color of the intermediate coat shall contrast with both the primer and finish coat. The intermediate coat shall conform with Mil-P-2441, Formula 150. The wash primer the coat for the alternate System shall conform to Mil-P-15329.
  - (3) Finish coat shall be applied as recommended by the manufacturer in a single application employing multiple spray passes. The finish coat for the Standard (epoxy intermediate) and alternate (wash primer the coat) shall conform with SSPC-8-64 or 9-64. When using epoxy intermediate coat see comments under 700.04C1.
- The Contractor shall submit finish coat color chips for selection of color by the Engineer.
- (e) System 4 Alkyd-Oil Basic Lead Silico-chromate System.
    - (1) Prime coat shall conform to TT-P-615 or AASHTO M-229.
    - (2) Intermediate coat shall be the same as the prime coat but united to contrast with both the prime coat and the finish coat.

**DRAFT****555.22 Preparing Metal Surfaces for Painting.**

All surfaces of new structural steel which are to be painted shall be blast cleaned unless otherwise specified in the special provisions or approved in writing by the Engineer.

In repainting existing structures where partial cleaning is required, the method of cleaning will be specified in the special provisions.

The steel surfaces to be painted shall be prepared as outlined in the "Steel Structures Painting Council" specifications (SSPC) meeting one of the following classes of surface preparation:

1. SSPC-SP-5 White Metal Blast Cleaning
2. SSPC-SP-6 Commercial Blast Cleaning.
3. SSPC-SP-8 Pickling
4. SSPC-SP-10 Near-White Blast Cleaning.

Blast cleaning shall leave all surfaces with a dense and uniform anchor pattern of not less than one and one half mils as measured with an approved surface profile comparator, or Testx Presse Tape.

Blast cleaned surfaces shall be primed or treated the same day blast cleaning is done. If cleaned surfaces rust or are contaminated with foreign material before painting is accomplished, they shall be recleaned by the contractor at his expense.

When paint systems No.1 or 3 are specified the steel surfaces shall be blast cleaned in accordance with SSPC-SP-10.

**555.23 Systems of Paint.** The paint system to be applied shall consist of one as set forth in Table 1 and as modified in the special provisions.

Table 1 - Paint Systems

Environment	Paint System				
	1	2	3	4	5
High Pollution or Coastal	X	X	X		
Mild climate				X	X

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Note: 1. Paint system shown for severe areas are satisfactory in less severe areas.

2. Coastal - within 1000 ft. of ocean or tidal water. High pollution - air pollution environment such as industrial areas.  
Mild - other than coastal areas not in air pollution environment.

All structural steel shall be painted by one of the following systems. The required system or choice of systems will be shown in the contract.

System 4 is intended for use in mild climates or to repaint existing structures where the other systems are not compatible.

<u>Coating</u>	<u>Specifications</u>	<u>Min Dry Film Thickness (Mils)</u>
System 1 - Vinyl Paint System		
Wash primer	708.03(b)	0.5
Intermediate coat	703.03(b)	1.5-2.0
3rd coat	708.03(b)	1.5-2.0
4th coat	708.03(b)	1.5-2.0
Finish coat	708.03(b)	1.5-2.0
Total Thickness		6.5-8.5
System 2 - Epoxy-Polyamide System		
Prime coat	708.03(c)	2.0-3.0
Intermediate coat	708.03(c)	2.0-3.0
3rd coat	708.03(c)	2.0-3.0
Finish coat	708.03(c)	1.5-2.0
Total thickness		7.5-11.0

The third coat may be eliminated in mild climates.



<u>Coating</u>	<u>Specifications</u>	<u>Min Dry Film Thickness (Mils)</u>
System 3 - Inorganic Zinc-Rich Coating System		
Epoxy	Prime coat	708.03(d) 3.5-5.0
	Intermediate coat	703.03(d) 1.0-2.0 - 20 30
	Finish coat	708.03(d) 3.0 min - 15 20
Total Thickness		7.0-10.0

Alternate System

Prime coat	708.03(d)	3.5-5.0
Wash primer tie coat	708.03(d)	0.5 min
Finish coat	708.03(d)	1.5-2.0
Total Thickness		5.5-7.5

System 4 - Alkyd-oil - Basic lead silico-Chromate System

Prime coat	708.03(e)	1.5-2.0
Intermediate coat	708.03(e)	1.5-2.0
Finish coat	708.03(e)	1.5-2.0
Total Thickness		5.0 mils

This paint system may be specified as four coats for new structure steel, in mild climates, with a minimum thickness of 6.0 mils.

System 5 - Organic Zinc-Rich Paint System

Prime coat	708.03(f)	1.5-2.0
Intermediate coat	708.03(f)	2.0-2.5
Wash primer tie coat	708.03(f)	0.5
Finish coat	708.03(f)	1.5-2.0
Total Thickness		5.5-7.0

#### 555.24 Painting metal Surfaces:

(a) Time of application. -- The prime coat of paint, or pretreatment when specified, shall be applied as soon as possible after the surface has been cleaned and before deterioration of the surface occurs. Any oil, grease, soil, dust, or foreign matter deposited on the surface after the surface preparation is completed shall be removed prior to painting. In the event the rusting occurs after completion of the surface preparation, the surfaces shall be again cleaned.

Particular care shall be taken to prevent the contamination of cleaned surfaces with salts, acids, alkali, or other corrosive chemicals before the prime coat is applied and between applications of the remaining coats of paint. Such contaminants shall be removed from the surface. Under these circumstances, the pretreatments or, in the absence of a pretreatment, the prime coat of paint shall be applied immediately after the surface has been cleaned.

(b) Storage of paint and thinner. -- All paint and thinner should preferably be stored in a separate building or room that is well ventilated and free from excessive heat, sparks, flame, or the direct rays of the sun. Paints susceptible to damage from freezing shall be kept in a heated storage space when necessary.

All containers of paint should remain unopened until required for use. Containers which have been opened shall be used first.

Paint which has livered, gelled, or otherwise deteriorated during storage shall not be used. Thixotropic materials which may be stirred to attain normal consistency are satisfactory.

(c) Mixing and thinning. -- All ingredients in any container of paint shall be thoroughly mixed before use and shall be agitated often enough during application to keep the pigment in suspension.

Paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the vehicle. This does not imply that part of the vehicle cannot be poured off temporarily to simplify the mixing.

Mixing shall be by mechanical methods, except that hand mixing will be permitted for containers up to 5 gallons in size.

Mixing in open containers shall be done in a well ventilated area away from sparks or flames.

Paint shall not be mixed or kept in suspension by means of an air stream bubbling under the paint surface.

When a skin has formed in the container, the skin shall be cut loose from the sides of the container, removed, and discarded. If such skins are thick enough to have a practical effect on the composition and quality of the paint, the paint shall not be used.

The paint shall be mixed in a manner which will insure breaking up of all lumps, complete dispersion of settled pigment, and a uniform composition. If mixing is done by hand, most of the vehicle shall be poured off into a clean container. The pigment in the paint shall be lifted from the bottom of the container with a broad, flat paddle, lumps shall be broken up, and the pigment thoroughly mixed with the vehicle. The poured-off vehicle shall be returned to the paint with simultaneous stirring, or pouring repeatedly from one container to another until the composition is uniform. The bottom of the container shall be inspected for unmixed pigment.

Tinting pastes or colors shall be wetted with a small amount of thinner, vehicle, or paint and thoroughly mixed. The thinned mixture shall be added to the large container of paint and mixed until the color is uniform.

Paint which does not have a limited pot life, or does not deteriorate on standing, may be mixed at any time before using, but if settling has occurred it must be remixed immediately before using. Paint shall not remain in spray pots, painters' buckets, etc., overnight, but shall be gathered into a container and remixed before use.

No thinner shall be added to the paint unless necessary for proper application. In no case shall more than one pint of thinner be added per gallon unless the paint is intentionally formulated for greater thinning.

The type of thinner shall comply with the paint specification.

When the use of thinner is permissible, thinner shall be added to paint during the mixing process. Painters shall not add thinner to paint after it has been thinned to the correct consistency.

All thinning shall be done under supervision of one acquainted with the correct amount and type of thinner to be added to the paint.

(d) Application of paint:

(1) General.-- The oldest of each kind of paint shall be used first. Paint shall be applied by brushing or spraying or a combination of these methods. Daubers or sheepskins may be used when no other method is practicable for proper application in places of difficult access. Dipping, roller coating, or flow coating shall be used only when specifically authorized.

All paints shall be applied in accordance with manufacturer's instructions.

Open seams at contact surfaces of built up members which would retain moisture shall be caulked with red lead paste, or other approved material, before the second undercoat of paint is applied.

Paint shall not be applied when the surrounding air temperature is below 40°F. Paint shall not be applied when the temperature is expected to drop to 32°F before the paint has dried. Paint shall not be applied to steel that is more than 5°F below the air temperature or that is at a temperature less than 40°. Paint shall not be applied when steel surface is less than 5°F above the dew point. (ASTM E-337-G2). Paint shall not be applied to steel at a temperature over 125°F unless the paint is specifically formulated for application at the proposed temperature, nor shall paint be applied to steel which is at a temperature that will cause blistering or porosity or otherwise will be detrimental to the life of the paint.

Paint shall not be applied in fog or mist, or when it is raining or snowing or when the relative humidity exceeds 85 percent. Paint shall not be applied to wet or damp surfaces. Paint shall not be applied on frosted or ice-coated surfaces.

When paint must be applied in damp or cold weather, the steel shall be painted under cover, or protected, or sheltered, or the surrounding air and the steel heated to a satisfactory temperature. In all such cases, the above temperature and humidity conditions shall be met. Such steel shall remain under cover or be protected until dry or until weather conditions permit its exposure.

Any applied paint exposed to freezing, excess humidity, rain, snow, or condensation shall first be permitted to dry. Then damaged areas of paint shall be removed, the surface again prepared and then repainted with the same number of coats of paint of the same kind as the undamaged areas.

If stripe painting is stipulated in the special provisions or if the Contractor chooses to do so at his option, all edges, corners, crevices, rivets, bolts, welds, and sharp edges shall be painted with the priming paint by brush before the steel receives its first full prime coat of paint. Such striping shall extend for at least 1 inch from the edge. When practicable, this stripe coat shall be permitted to dry before the prime coat is applied; otherwise, the stripe coat shall set to touch before the full prime coat is applied. However, the stripe coat shall not be permitted to dry for a period long enough to allow rusting of the unprimed steel. When desired, the stripe coat may be applied after a complete prime coat.

To the maximum extent practical, each coat of paint shall be applied as a continuous film of uniform thickness, free of pores. Any thin spots or areas missed in the application shall be repainted and permitted to dry before the next coat of paint is applied.

Film thickness are included in description of paint systems.

Each coat of paint shall be in a proper state of cure or dryness before the application of the succeeding coat.

(2) Brush application. -- Paint shall be worked into all crevices and corners where possible and surfaces not accessible to brushes shall be painted by spray, daubers, or sheepskins. All runs or sags shall be brushed out. There shall be a minimum of brush marks left in the applied paint.

(3) Spray application of paint. -- The equipment used for spray application of paint shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gages. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application. In closed or recirculating paint spray systems, where gas under pressure is used over the liquid, the gas shall be an inert one, such as nitrogen.

Traps or separators shall be provided to remove oil and water from the compressed air. These traps or separators shall be of adequate size and shall be drained periodically during operations. The air from the spray gun impinging against the surface shall show no water or oil.

Paint ingredients shall be kept properly mixed in the spray pots or containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

The pressure on the material in the pot and of the air at the guns shall be adjusted for optimum spraying effectiveness. The pressure on the material in the pot shall be adjusted when necessary for changes in elevation of the gun above the pot. The atomizing air pressure at the gun shall be high enough to atomize the paint properly but not so high as to cause excessive fogging of paint, excessive evaporation of solvent, or loss by overspray.

Spray equipment shall be kept sufficiently clean so that dirt, dried paint, and other foreign materials are not deposited in the paint film. Any solvents left in the equipment shall be completely removed before applying paint to the surface being painted.

Paint shall be applied in a uniform layer, with overlapping at the edge of the spray pattern. The spray pattern shall be adjusted so that the paint is deposited uniformly. During application, the gun shall be held perpendicular to the surface and at a distance which will insure that a wet layer of paint is deposited on the surface. The trigger of the gun should be released at the end of each stroke.

All runs and sags shall be brushed out immediately or the paint shall be removed and the surface repainted. Spray application of prime coats shall in all cases be immediately followed by brushing.

Areas inaccessible to the spray gun shall be painted by brush. If not accessible by brush, daubers or sheepskins shall be used. Brushes shall be used to work paint into cracks, crevices, and blind spots which are not adequately painted by spray.

(2) Shop painting. -- Shop painting shall be done after fabrication and before any damage to the surface occurs from weather or other exposure. Shop contact surfaces shall not be painted unless specified.

Surfaces not to be in contact but which will be inaccessible after assembly shall receive the full paint system specified or three shop coats of the specified primer before assembly.

The areas of steel surfaces to be in contact with concrete shall not be painted. Unless otherwise shown on the plans, the areas of steel surfaces to be in contact with wood shall receive either the full paint coats specified or three shop coats of the specified primer.

If paint would be harmful to a welding operator or would be detrimental to the welding operation or the finished welds, the steel shall not be painted within a suitable distance from the edges to be welded.

Antiweld spatter coatings shall be removed before painting. Weld slag and flux shall be removed by methods at least as effective as those specified for the cleaning.

Machine-finished or similar surfaces that are not to be painted, but do not require protection, shall be protected with a coating of rust inhibitive petroleum, or other coatings which may be more suitable for special conditions.

Erection marks and weight marks shall be copied on areas that have been previously painted with the shop coat.

(5) Field painting. -- Steel structures shall be painted as soon as practicable after erection.

Metal which has been shop coated shall be touched up with the same type of paint as the shop coat. This touch-up shall include cleaning and painting of field connections, welds, rivets, and all damaged or defective paint and rusted areas. The Contactor may at his option apply an overall coat of primer in place of touch-up or spot painting.

Surfaces (other than contact surfaces) which are accessible before erection but which will not be accessible after erection shall receive all field coats of paint before erection.

If possible, the final coat of paint shall not be applied until all concrete work is finished. If concreting or other operations damage any paint, the surface shall be cleaned and repainted. All cement or concrete spatter and drippings shall be removed before any paint is applied.

Wet paint shall be protected against damage from dust or other detrimental foreign matter to the extent practicable.

(6) Drying of painted metal. -- The maximum practicable time shall be allowed for paint to dry before recoating or exposure. No drier shall be added to paint on the job unless specifically called for in the specification for the paint. No painted metal shall be subjected to immersion before the paint is dried through. Paint shall be protected from rain, condensation, contamination, snow, and freezing until dry, to the fullest extent practicable.

(7) Handling of painted steel. -- Painted steel shall not be handled until the paint has dried, except for necessary handling in turning for painting or stacking for drying.

Paint which is damaged in handling shall be scraped off and touched up with the same number of coats and kinds of paint as were previously applied to the steel.

Painted steel shall not be loaded for shipment or shipped until it is dry.

Precautions shall be taken to minimize damage to paint films resulting from stacking members.

(e) Measurement of Dry Film Thickness of Paints.

(1) Instrumentation. -- Dry paint film thicknesses shall be measured using Pull-Off (Type 1) or Fixed-Probe (Type 2) Magnetic Gages. Type 1 gages include Tinsley, Elcometer, Microtest, and Inspector models. Type 2 gages include Elcometic, Minitector, General Electric, Verimeter, and Accuderm models.

(2) Calibration

a. Type 2 (Pull-off) Magnetic Gages measure the coating thickness on a series of reliable standards covering the expected range of paint thickness. Record the calibration correction either + or — required at each standard thickness. To guard against gage drift during use, re-check occasionally with one or more of the standards.

When the gage adjustment has drifted so far that large corrections are needed, it is advisable to re-adjust closer to the standard values and recalibrate.

For Type 1 gages, the preferred basic standards are small, chromeplated steel panels that may be available from the National Bureau of Standards in coating thicknesses from 0.5 to 8 mils.

Plastic shims of certified thicknesses in the appropriate ranges may also be used to calibrate the gages. The gage is held firmly enough to press the shim tightly against the steel surface. Record the calibration correction as above.



#### b. Type 2 (fixed Probe) Magnetic Gages

Shims of plastic or of non-magnetic metals laid on the appropriate steel base (at least 3 x 3 X 0.125 inch (7.6 X 7.6 X 0.32 cm) are suitable working standards. These gages are held firmly enough to press the shim tightly against the steel surface. One should avoid excessive pressure that might indent the plastic or, on a blast cleaned surface, might impress the steel peaks into the undersurface of the plastic.

The National Bureau of Standards standard panels shall not be used to calibrate Type 2 gages.

#### (3) Measurement procedures

To determine the effect of the substrate surface condition on the gage readings, access is required to some unpainted areas.

Repeated gage readings, even at points close together, may differ considerably due to small surface irregularities. Three gage readings should therefore be made for each spot measurement of either the substrate or the paint. Move the probe a short distance for each new gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take the average of the three gage readings as the spot measurement.

#### a. Measurement with Type 1 (Pull-off) Gage

Measure (A), the bare substrate, at a number of spots to obtain a representative average value.

Measure (B), the dry paint film, at the specified number of spots. (See Section 3 for number).

Correct the (A) and (B) gage readings or averages as determined by calibration of the gage.

Subtract the corrected readings (A) from (B) to obtain the thickness of the paint above the peaks of the surface.

#### b. Measurement with Type 2 (Fixed Probe) Gage

Place a standard shim of the expected paint thickness on the bare substrate that is to be painted. Adjust the gage in place on the shim so that it indicates the known thickness of the shim.

Conform the gage setting by measuring the shim at several other areas of the bare substrate. Re-adjust the gage as needed to obtain an average setting representative of the substrate.

With the gage adjusted as above, measure the dry paint film at three points. The gage readings indicate the paint film at three points. The gage readings indicate the paint thickness above the peaks of the surface profile.

Re-check the gage setting at frequent intervals during a long series of measurements.

Make five (5) separate spot measurements spaced evenly over each section of the structure 100 square feet in area, or of other area as may be specified. The average of five spot measurements for each such section shall be not less than the specified thickness. No single spot measurement (average of three readings -- in any section shall be less than 80% of the specified thickness.

Since paint thickness is usually specified (or implied) as a minimum, greater thickness that does not cause defects of appearance or functions, such as mud cracking, wrinkling, etc. is permitted unless otherwise specified.

#### (4) Special Notes

a. All of the above magnetic gages, if properly adjusted and in good condition, are inherently accurate to within  $\pm 15\%$  of the true thickness of the coating.

b. Much larger, EXTERNAL errors may be caused by variations in method of use of the gages or by unevenness of the surface of the substrate or of the coating. Also, any other films present on the steel (rust or mill scale or even a blast cleaned profile zone) will add to the apparent thickness of the applied paint film.

c. The surface of the paint and the probe of the gage must be free from dust, grease and other foreign matter in order to obtain close contact of the probe with the paint and also to avoid adhesion of the magnet. The accuracy of the measurement will be affected if the coating is tacky or excessively soft.

d. The magnetic gages are sensitive to geometrical discontinuities of the steel, as at holes, corners or edges. the sensitivity to edge effects and discontinuities varies from gage to gage. Measurements closer than one inch (2.5cm) from the discontinuity may not be valid unless the gage is calibrated specifically for that location.

e. Magnetic gage readings also may be affected by proximity to another mass of steel close to the body of the gage, by surface curvature, and by presence of other magnetic fields.

f. All of the magnets or probes must be held perpendicular to the painted surface to produce valid measurements.

### 703.03 Paint for Steel Structures.

(a) General. All paint furnished must be shipped in strong, substantial containers, plainly marked with the name, weight, and volume of paint content, together with the color, formula, and the name and address of the manufacturer.

Paint systems shall be of the type shown on the plans or in the special provisions.

Except as otherwise required in the cited specifications, all paint shall meet the following general requirements:

(1) The paint shall not show excessive settling in a freshly-opened full can, and shall easily be redispersed with a paddle to a smooth, homogeneous state. The paint shall show no curdling, livering, caking or color separation, and shall be free from lumps and skins.

(2) The paint as received shall brush easily, possess good leveling properties, and show no running or sagging tendencies when applied to smooth steel vertical surfaces.

(3) The paint shall not skin within 48 hours in a three-quarters filled closed container.

(4) The paint shall dry to a smooth uniform finish, free from roughness, grit, unevenness, and other surface imperfections. The paint shall show no streaking or separation when flowed on clean glass.

(5) The paint shall show no thickening, curdling, gelling, or hard caking after six months storage in a full, tightly-covered container at a temperature of 70°F.

(b) System 1- - Vinyl Paint System

- (1) Vinyl wash primer shall conform to Mil-P15328.
- (2) Vinyl intermediate coat shall conform to Mil-P15929, Mil-P15930, or SSPC 8-64 or 9-64.
- (3) Third and fourth coat shall be the same as the intermediate coat.
- (4) Finish coat shall be the same as the intermediate coat or SSPC-8-64 or 9-64 or IT-P-615 to obtain the desired finish color.

(c) System 2 - Epoxy-Polyamide Paint System.

- (1) Primer coat shall conform to Mil-P-24441, Formula 150 and the color as specified.
- (2) Intermediate coat and third coat shall conform to Mil-P-24441, using contrasting color sequences.
- (3) Finish coat shall conform to SSPC-8-764 or 9-64 or IT-P-615 to obtain the desired finish coat, and shall be applied in accordance with the recommendations of the manufacturer of the undercoat. It is recommended that the entire paint system be supplied by the same manufacturer.

(d) System 3 Inorganic Zinc Silicate System.

- (1) Prime coat. Inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed, cures without the use of a separate curing solution, and shall have the properties described herein.

Pigment. The zinc pigment component shall comply with the requirements of ASTM D 520-51 (1970) for Type II. The average particle size of the zinc powder shall not exceed 10 microns as determined by the Fisher Sub-sieve sizer.

Vehicle. The vehicle component shall consist primarily of an alkyl silicate in an appropriate alcohol solvent. Total solids, by content shall be determined by drying the sample to a constant weight at 100C.

Mixed Paint. Mixed paint shall conform to the following requirements:

- a. The zinc portion shall be at least 75 percent by weight of the total solids of the dried coating.
- b. The total solids, when heated at 100 C for 3 hours, shall be not less than 72 percent by weight.
- c. The paint shall tolerate up to one percent water contamination without gellation.
- d. The usable pot life of the mixed paint shall be not less than 12 hours at 77F. There shall be no hard settling which cannot be easily redispersed during this period.
- e. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the topcoat.

Resistance Tests. Test panels of steel meeting the requirements of ASTM D 609-73 having dimensions of 2 by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to the same degree specified under Sec. 555.22. A 3-4 mil coating (dry thickness) shall then be applied to the test panels in accordance with the manufacturer's current printed instruction. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on a minimum of three panels. The material will not be accepted if any individual test panel fails any of the following tests:

- a. Fresh Water Resistance. Panels shall be scribed down to base metal with an X of at least 2-inch legs and shall be immersed in fresh tap water at  $75\text{ F} \pm 5\text{ F}$ . The panels shall show not rusting, blistering, or softening when examined after 30 days.
- b. Salt Water Resistance. Panels shall be scribed down to base metal with an X of at least 2-inch legs and immersed in 5 percent sodium chloride at  $75\text{ F} \pm 5$  at 7, 14 and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.
- c. Weathering resistance. Panels shall be tested in accordance with ASTM G 23-69, type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel, or blistering.

d. Weather and Salt Fog Resistance. Panels shall be tested in the weatherometer as specified in c. for 300 hours. After this period the panels shall be removed and scribed with an X of at least 2-inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-73. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

e. Resistance to Elevated Temperatures and Thermal Shock. Panels shall be exposed to a temperature of 500 F for one hour, then quenched immediately in 65F  $\pm$  5F water. Panels subjected to this test shall show no blistering or flaking of the coating.

f. Adhesion panels shall be tested in accordance with ASTM D - 3359 and shall attain a rating of 3 or greater.

g. Mud Cracking Resistance. The coating when applied to test panels as above to a 5 to 6 mil dry film thickness shall show not mud cracking when viewed under 10-X magnification.

Manufacturer and Brand Name Approval for Inorganic Zinc Primer. Prior to approval and use of inorganic zinc, the contractor shall submit in triplicate to the Engineer a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative and resistance test requirements of these specifications. The certified test report shall also contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the Engineer of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of 2 years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed, and may be required by the Engineer when sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

*epoxy-polyamide*  
(2) Intermediate coat shall be applied as recommended by the manufacturer in a single application employing multiple spray passes. The color of the intermediate coat shall contrast with both the primer and finish coat. The ~~tie~~ coat shall conform with Mil-P-15328, or Mil-P-24441, Formula 150. *intermediate*

*The wash primer tie coat for the alternate system shall conform with MIL-P-15328.*

(3). Finish coat shall be applied as recommended by the manufacturer in a single application employing multiple spray passes. The finish coat shall conform with SSPC-C-64 or 9-64. ~~For HSP-2441 when using~~ ~~intermediate coat see comments under System 2, Finish coat, 708.03, 0.3~~ ~~for the standard (epoxy intermediate) and alternate (with primer 40-101).~~

The Contractor shall submit finish coat color chips for selection of color by the Engineer.

(e) System 4 Alkyd-Oil Basic Lead Silico-chromate System.

(1) Prime coat shall conform to TT-P-615 or AASHTO M-239.

(2) Intermediate coat shall be the same as the prime coat but tinted to contrast with both the prime coat and the finish coat.

(3) Finish coat shall be the same as the prime coat but tinted to National Park Service green or gray as specified in the contract.

(f) System 5 Organic Zinc-rich Paint System.

(1) Prime coat shall conform to the following requirements:

Description:

This specification covers a one-package, thermoplastic organic zinc-rich primer whose mechanism of drying is that of solvent release. It is intended for use only on blast cleaned open steel structures exposed to the air.

Composition:

Pigment Ingredients  
(62.3 Percent of Composition Weight, Minimum)

	Specification	Parts by Weight of Pigment	
		Type I, Red Tint	Type II, Gray
Zinc Dust	ASTM D-520	95.0 min	95.0 min
Red Iron Oxide <sup>2</sup>	TT-P-460, Type I	1.5 max	1.5 max
Zinc Oxide	TT-P-463, Type I, Grades A or B	3.5 max	3.5 max
Thixotropes and Additives			



Vehicle Ingredients  
(37.7 Percent of Composition Weight, Maximum)

	Specifications	Parts by Weight of Vehicle
Polyaryl Ether <sup>3</sup>		19.0
Ethylene Glycol Monoethyl Ether Acetate	MIL-E-7125	66.8
Toluene	II-T-548	14.2

<sup>1</sup> Except the metallic zinc content shall be 95 percent by weight.

<sup>2</sup> Fe<sub>2</sub>O<sub>3</sub> 98.5% minimum; oil absorption, 21; fineness through 325 mesh screen, 99% minimum; and specific gravity, 5.15.

<sup>3</sup> A polyhydroxy polyalkaryl polyether of the following properties:

Specific gravity	1.18
Viscosity of 49% solids in methyl ethyl ketone, Brookfield RVF, 20 rpm No. 5 spindle	5,500 to 7,700 cps
Reduced viscosity (0.2 g/100 ml. dimethylformamide)	0.4 to 0.6
Ultimate tensile strength	9,000 to 9,500 psi
Ultimate tensile elongation	50 to 100%
Softening temperature	212°F.
Bulking value	9.83 lbs. per. gal.

The average particle size of the pigment shall not exceed 9 microns as determined by the Fisher Sub-Sieve Sizer. The Red Iron Oxide must first be ground into a portion of the vehicle to provide a Hegman grind sufficient to produce the specified color of the finished paint.

The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

**Infrared Characteristic Curve of Primer Vehicle:**

When dried upon a potassium bromide disc, a film of the primer shall have infrared absorption maximums at the same wavelengths and to the same relative degree as that shown by the curve on file in the FHWA Laboratory.

The composition of the extracted zinc dust pigment shall match the X-ray diffraction curve on file at the Laboratory.

The paint shall in addition to the preceding composition conform to the following table of requirements:

#### Characteristics of Paint:

Volatiles at 105° C., percent by weight	28-32
Weight per gallon, pounds	17.2-18.0
Viscosity, KU at 77°F.	100-120
Metallic zinc, percent by weight of extracted pigment by Federal Test method N. 141., Method 7221	90.2 min
Dry time at 77°F., 50% relative humidity, 6 mil	
Wet thickness:	
Set to touch, hours	3/4 max
Dry hard, hours	5 max
Storage life, years	1 min

#### Properties of Cured Coating:

When applied to a plate glass panel with a 6 mil gap clearance doctor blade and cured for 15 days at 77° ± 5°F. and 50 ± 5% relative humidity, the coating shall have the following properties:

Pencil Hardness	8 min
Color (for Type I only)	Not Lighter Than Federal Standard Color 31575

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on blast cleaned steel having an anchor profile pattern of one to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by blast cleaning to produce a one to 1.5 mil anchor pattern, and cured for 15 days at a relative humidity of 50 ± 5% and tested according to the Conical Mandril Test, Federal Test method standard No. 141, Method 6222, there shall be no loosening of the film above the point of the longest continuous crack.

When a steel panel is blast cleaned to white metal and coated with 3-4 mils dry film thickness of this coating and cured for 15 days at 75° ± 2° F. and 50 ± 5% relative humidity and diagonally scribed to expose base steel, there shall be no underfilm corrosion on the surface of the panel extending beyond the scribed lines after 1,000 hours when tested according to ASTM designation B-117.

Prior to use, the paint shall be thinned with not more than one volume of thinner to 4 volumes of paint using a power agitated stirrer. The thinner shall consist of a mixture of 82 percent by volume of ethylene glycol monoethyl ether acetate and 18 percent by volume of toluene.

(2) Intermediate coat shall be the same as the prime coat tinted to contrast with both the prime coat and the vinyl wash coat.

(3) Vinyl wash tie coat shall conform to Mil-P-15328.

(4) Finish coat shall conform to SSPC-8-64 or 9-64 or IT-P-615 with the color as specified in the contract.

(g) Sampling and testing -- Unless otherwise specified, sampling will be performed in accordance with method 1021, Federal Test Method No. 141.

The paint will be tested in accordance with methods of Federal Test Method Standard No. 141, as follows:

Test:	Method
Percentage of pigment -----	4021
Isolation of vehicle -----	4032
Non-volatile in vehicle -----	4053
Phthalic anhydride -----	7021
Uncombined water 4081 or -----	4082
Consistency: Krebs-Stormer -----	4281
Coarse particles and skins -----	4091
Weight per gallon -----	4184
Set to touch time -----	4061
Condition in container -----	3011
Brushing properties -----2141,	4321
Skinning -----	4141
Rosin and resin derivatives -----	5031
Storage stability -----	4142
Dry through time -----	4061
Fineness of grind -----	4411

<sup>1</sup> A gravity convection oven may be used to determine the non-volatile content of the supercentrifuged vehicle if the procedure outlined in Method 4041 is modified as follows: Weigh accurately from 0.8 to 1.2g. of sample (by difference), heat for one hour, cool and weigh. Use the lower value to calculate the percentage of non-volatile matter.

<sup>2</sup> Make the test on a portion of the isolated vehicle.

INORGANIC ZINC-RICH COATING SYSTEM  
FROM  
PROPOSED STANDARD SPECIFICATIONS FP-79

(d) System 3 Inorganic Zinc Silicate System.

(1) Prime coat. Inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed, cures without the use of a separate curing solution, and shall have the properties described herein.

Pigment. The zinc pigment component shall comply with the requirements of ASTM D 520-51 (1970) for Type II. The average particle size of the zinc powder shall not exceed 10 microns as determined by the Fisher Sub-sieve sizer.

Vehicle. The vehicle component shall consist primarily of an alkyl silicate in an appropriate alcohol solvent. Total solids, by content shall be determined by drying the sample to a constant weight at 100C.

Mixed Paint. Mixed paint shall conform to the following requirements:

- a. The zinc portion shall be at least 75 percent by weight of the total solids of the dried coating.
- b. The total solids, when heated at 100 C for 3 hours, shall be not less than 72 percent by weight.
- c. The paint shall tolerate up to one percent water contamination without gellation.
- d. The usable pot life of the mixed paint shall be not less than 12 hours at 77F. There shall be no hard settling which cannot be easily redispersed during this period.
- e. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the topcoat.

Resistance Tests. Test panels of steel meeting the requirements of ASTM D 609-73 having dimensions of 2 by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to the same degree specified under Sec. 555.22. A 3-4 mil coating (dry thickness) shall then be applied to the test panels in accordance with the manufacturer's current printed instruction. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on a minimum of three panels. The material will not be accepted if any individual test panel fails any of the following tests:

- a. Fresh Water Resistance. Panels shall be scribed down to base metal with an X of at least 2-inch legs and shall be immersed in fresh tap water at 75 F  $\pm$  5 F. The panels shall show not rusting, blistering, or softening when examined after 30 days.
- b. Salt Water Resistance. Panels shall be scribed down to base metal with an X of at least 2-inch legs and immersed in 5 percent sodium chloride at 75 F  $\pm$  5 at 7, 14 and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.
- c. Weathering resistance. Panels shall be tested in accordance with ASTM G 23-69, type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel, or blistering.

d. Weather and Salt Fog Resistance. Panels shall be tested in the weatherometer as specified in c. for 300 hours. After this period the panels shall be removed and scribed with an X of at least 2-inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-73. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

e. Resistance to Elevated Temperatures and Thermal Shock. Panels shall be exposed to a temperature of 500 F for one hour, then quenched immediately in 65F  $\pm$  5F water. Panels subjected to this test shall show no blistering or flaking of the coating.

f. Adhesion panels shall be tested in accordance with ASTM D - 3359 and shall attain a rating of 3 or greater.

g. Mud Cracking Resistance. The coating when applied to test panels as above to a 5 to 6 mil dry film thickness shall show not mud cracking when viewed under 10-X magnification.

Manufacturer and Brand Name Approval for Inorganic Zinc Primer. Prior to approval and use of inorganic zinc, the contractor shall submit in triplicate to the Engineer a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative and resistance test requirements of these specifications. The certified test report shall also contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the Engineer of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of 2 years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed, and may be required by the Engineer when sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

(2) Intermediate coat shall be applied as recommended by the manufacturer in a single application employing multiple spray passes. The color of the intermediate coat shall contrast with both the primer and finish coat. The tie coat shall conform with Mil-P-15328, or Mil-P-24441, Formula 150.

(3) Finish coat shall be applied as recommended by the manufacturer in a single application employing multiple spray passes. The finish coat shall conform with SSPC-8-64 or 9-64. For Mil-P-24441 intermediate coat see comments under System 2. Finish Coat.

The Contractor shall submit finish coat color chips for selection of color by the Engineer.

Proposed A.A.S.H.T.O. Specification Revision to  
PAINTING METAL STRUCTURES

Section 14 - PAINTING METAL STRUCTURES

2.14.1 - GENERAL

(A) Description

The painting of metal structures shall include the preparation of the metal surfaces, the application, protection and drying of the paint coatings, the protection of pedestrian, vehicular or other traffic upon or underneath the structure, the supply of all tools, equipment, scaffolding, labor and materials necessary for completion of the work involved in painting the exposed surfaces of metal structures.

(B) Weather Conditions

Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather. Painting will not be permitted when the atmospheric temperature is at or below 40°F (4°C) when using vinyl, alkyd, and organic materials, and 50°F (10°C) when using inorganic zinc, or when the humidity exceeds 85 percent at the site of the work, or when freshly painted surfaces may become damaged by rain, fog or dust, or when it can be anticipated that the atmospheric temperature will drop below 40°F (4°C) during the drying period, except as provided herein for painting in enclosures.

Subject to approval of the Engineer, the contractor may provide a suitable enclosure to permit painting during inclement weather. Provisions shall be made to artificially control atmospheric conditions inside the enclosure within limits suitable for painting throughout the painting operation. Full compensation for providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work involving painting and no additional compensation will be allowed therefor.

All blast cleaning, except that performed within closed buildings, and all painting shall be performed during daylight hours unless the terms of the contract prohibit work being performed during daylight hours.

## 2.14.2 - PAINT SYSTEM AND COLOR

The paint system to be applied shall consist of one set forth in the following Table I and as modified in the special provisions.

Table I

	High Pollution and Coastal	Mild Climate	Mild Climate or Spot Painting
Pre-treatment or undercoat	Vinyl Wash	Inorganic Zinc 2 appl - 4 mils total	Organic Zinc 2 appl - 3 mils total
Undercoat or pre-treatment	Vinyl Primer - Red Iron Oxide Appl 1 & 3	Vinyl Wash	Vinyl Wash
Undercoat or pre-treatment	Vinyl Primer - Titanium Dioxide Appl 2 & 4		
	Total 4 mils undercoat		
Finish	Vinyl 2 appl - 2 mils total	Alkyd 1 appl - 1½ mils total	Vinyl 2 appl - 2 mils total
	Total System 6 mils	5½ mils	5 mils

- Note:**
1. Paint system shown for severe areas are satisfactory in less severe areas.
  2. Paints shown are available in most desired colors.
  3. Coastal - within 1000 ft ocean or tidal water. High Pollution - air pollution environment such as industrial areas. Mild - other than coastal area not in air pollution environment.
  4. Paints shall conform to the material requirements as set forth in AASHTO Materials Specification. (Pending adoption by Materials Committee.)
  5. Finish coat of vinyl & alkyd for mild climate & spot systems may be interchanged.
  6. Other paints and paint systems may be specified at the discretion of the owner.



### 2.14.3 - CLEANING OF SURFACES

All exposed surfaces of structural steel, except galvanized or metalized surfaces, shall be cleaned and painted.

All surfaces of new structural steel or surfaces which are to be painted with inorganic zinc shall be blast cleaned unless otherwise specified in the special provisions, or approved in writing by the Engineer.

In repainting existing steel structures where partial cleaning is required, the method of cleaning will be specified in the special provisions. Any damage to sound paint, on areas not designated for treatment, resulting from the Contractor's operations shall be repaired by him at his expense to the satisfaction of the Engineer.

Cleaning of metal surfaces shall be performed as specified herein or as set forth in the special provisions. Cleaning methods shall conform to the following:

#### (A) Blast Cleaning

Abrasives used for blast cleaning shall be either clean dry sand, mineral grit, steel shot, or steel grit, at the option of the Contractor, and shall be a grading suitable to produce satisfactory results. The use of other abrasives will not be permitted unless approved in writing by the Engineer.

Unwashed beach sand containing salt or excessive amounts of silt will not be allowed.

All dirt, mill scale, rust, old paint and other foreign material shall be removed from steel surfaces by an approved blast cleaning apparatus. Blast cleaning shall be sufficient to give the surface the appearance as specified in SSPC 10 - near white, and shall leave all surfaces with a dense and uniform anchor pattern of not less than one mil as measured with an approved surface profile comparator.

When blast cleaning is being performed near machinery, all journals, bearings, motors and moving parts shall be sealed against entry of abrasive dust before blast cleaning begins.

Blast cleaned surfaces shall be primed or treated the same day blast cleaning is done, unless otherwise authorized by the Engineer. If cleaned surfaces rust or are contaminated with foreign material before painting is accomplished, they shall be recleaned by the Contractor at his expense.

### (B) Steam Cleaning

All dirt, grease, loose chalky paint or other foreign material which has accumulated on the previously painted or galvanized surfaces shall be removed with a steam cleaning apparatus which shall precede all other phases of cleaning. It is not intended that sound paint be removed by this process. Any paint which becomes loose, curled, lifted, or loses its bond with the preceding coat or coats after steam cleaning, shall be removed to sound paint or metal surface by the Contractor at his expense.

A detergent shall be added to the feed water of the steam generator. The detergent shall be of such composition and shall be added in such quantity that the cleaning as provided in the above paragraph is accomplished.

Any residue, detergent, or other foreign material which may accumulate on cleaned surfaces shall be removed by flushing with fresh water.

Steam cleaning shall not be performed more than two weeks prior to painting or other phases of cleaning.

Subsequent painting shall not be performed until the cleaned surfaces are thoroughly dry and in no case in less than 24 hours after cleaning.

### (C) Hand Cleaning

Wire brushes, either hand or powered, hand scraping tools, power grinders, or sandpaper shall be used to remove all dirt, loose rust and mill scale, or paint which is not firmly bonded to the metal surfaces.

Pneumatic chipping hammers shall not be used unless authorized in writing by the Engineer.

### 2.14.4 - APPLICATION

The Contractor shall notify the Engineer, in writing, at least one week in advance of the date cleaning and painting operations are to begin.

Painting shall be done in a neat and workmanlike manner. Unless otherwise specified, paint shall be applied by brush, spray, or roller, or any combination thereof peculiar to the paint being applied.

Each application of paint shall be thoroughly cured and any skips, holidays, thin areas or other deficiencies corrected before the succeeding application. The surface of the paint being covered shall be free from moisture, dust, grease or any

other deleterious materials which would prevent the bond of the succeeding applications. In spot painting, old paint which lifts after the first application, shall be removed by scraping and the area repainted before the next application.

Brushes, when used, shall have sufficient body and length of bristle to spread the paint in a uniform film. Paint shall be evenly spread and thoroughly brushed out.

On all surfaces which are inaccessible for painting by regular means, the paint shall be applied by sheepskin daubers, bottle brushes, or by any other means approved by the Engineer.

Rollers, when used, shall be of a type which do not leave a stippled texture in the paint film.

A water trap acceptable to the Engineer shall be furnished and installed on all equipment used in spray painting.

Mechanical mixers shall be used to mix paint. Prior to applying, the paint shall be mixed a sufficient length of time to thoroughly mix the pigment and vehicle together, and shall be kept thoroughly agitated during its application.

Paints specified are formulated ready for application and no thinning will be allowed unless otherwise provided in the applicable materials specification for the paint being used.

The dry film thickness of the paint will be measured in place with a calibrated magnetic film thickness gage.

The thickness of each application shall be limited to that which will result in uniform drying throughout the paint film.

Succeeding applications of paint shall be of such shade as to contrast with the paint being covered.

Zinc-rich primers shall be applied by spray methods. On areas inaccessible to spray application, the paint may be applied by brush or daubers.

Mechanical mixers shall be used in mixing the primer. After mixing, the zinc-rich primers shall be strained through a metal 30-60 mesh screen or a double layer of cheesecloth immediately prior to or during pouring into the spray pot.

An agitating spray pot shall be used in all spray application of zinc-rich primers. The agitator or stirring rod shall reach to within 2 inches of the bottom of the spray pot and shall be in motion at all times during primer application. Such motion shall be sufficient to keep the primer well mixed.

Cured organic zinc-rich primer shall be free from dust, dirt, salt or other deleterious deposits and thoroughly dry before applying vinyl wash primer.

Vinyl wash primer shall not be applied more than 72 hours before application of finishing coat paint. The vinyl wash primer shall be applied by spraying to produce a uniform wet film on the surface.

Structures shall be blast cleaned and painted with the total thickness of undercoats before erection. After erection and before applying subsequent paint, all areas where paint has been damaged or has deteriorated and all exposed unpainted surfaces shall be thoroughly cleaned and spot painted with undercoats to the specified thickness.

Surfaces exposed to the atmosphere and which would be inaccessible for painting after erection shall be painted the full number of applications prior to erection.

In addition, the application of inorganic zinc paints shall conform to the following:

Spray equipment shall provide the proper pot pressure and atomization pressure to produce a coating the composition of which shall comply in all respects to the specifications for the inorganic zinc paint. The hose from pot to nozzle shall not be more than 75 feet long, nor be used more than 15 feet above or below the pot.

Succeeding coats shall be applied within the following 24 hours. A minimum of 30 minutes shall elapse between applications.

In areas where "mud-cracking" occurs in the inorganic zinc paint, it shall be scraped back to soundly bonded paint, and recoated to the same thickness by the same methods specified for the original coat.

Paint shall be cured for 48 hours at a relative humidity of at least 45 percent before the application of vinyl wash primer. The cured inorganic zinc paint shall be hosed down with water and be in a surface dry condition before the application of vinyl wash primer if the vinyl wash primer is not applied within 3 weeks after the inorganic zinc paint is applied, or when there is evidence of dust, dirt, salt, or other deleterious deposits on the inorganic zinc paint.

Vinyl wash primer shall not be applied more than 48 hours before the application of finish coats.

#### 2.14.5 - PROTECTION AGAINST DAMAGE

The Contractor shall provide protective devices as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains which result in an unsightly appearance on surfaces not designated to be painted shall be removed or obliterated by the Contractor at his expense.

If traffic causes an objectionable amount of dust, the Contractor, when directed by the Engineer, shall sprinkle the adjacent roadbed and shoulders with water or dust palliative for a sufficient distance on each side of the location where painting is being done.

All painted surfaces that are marred or damaged as a result of operations of the Contractor shall be repaired by the Contractor, at his expense, with materials and to a condition equal to that of the coating specified herein.

Upon completion of all painting operations and of any other work that would cause dust, grease, or other foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be thoroughly cleaned. At the time of opening structures to public traffic, the painting shall be completed, and the surfaces shall be undamaged and clean.

#### 2.14.6 - PAINTING GALVANIZED SURFACES

All galvanized surfaces that are to be painted shall first be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease, or other materials foreign to the galvanized coating.

After washing, all areas shall be roughened by abrasive blasting using an abrasive that is no larger than 30 mesh. Galvanizing shall not be removed by this operation.

After preparation, all galvanized surfaces that are to be painted shall be covered with one application of zinc dust-zinc oxide primer, Federal Specification TT-P-641, Type II. The zinc dust-zinc oxide paint shall be applied by spraying to produce a complete covering of the galvanized surfaces.

After the application of zinc dust-zinc oxide paint, one application of pre-treatment, vinyl wash primer shall be applied to such surfaces. The vinyl wash primer shall be applied by spraying to produce a uniform wet film on the surface.

Such surfaces shall then be covered with two separate applications of white tint base vinyl finish coat, sufficient to completely cover the preceding color. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the second application. The final finish application shall be tinted to match the color shown on the plans or specified in the special provisions.

### Commentary

Section 14 of Division II, Construction needs to be rewritten for today's paint systems. The AASHTO Materials Committee is presently working on new paint specifications which may be used in conjunction with this proposed rewrite.

We recognize that many states and private organizations have developed their own specifications, but for those groups who have no specification this will provide a dependable package for both materials and paint systems. These specifications will not be imposed on the states.

Specifications for the application of paint must, by nature, correspond to a specific material specification. The composition of the paint selected, (i.e., percent solids), determines the possible thickness of any single application. Table I, in Article 2.14.2, presents paint systems which are consistent with the paint specifications recommended to the Materials Committee, copy attached. This may need revision to provide consistency with the final paint specifications adopted by the AASHTO Materials Committee.

Reducing the number of applications has been suggested by some committee members. This may be questionable economy in that the cost of blast cleaning and preparation with the present pollution controls amounts to more than 50% of the total cost of painting. Therefore, savings realized by the elimination of 1 or 2 applications of paint, does not justify sacrificing the life span of the paint system.

The material specifications, when complete, and the specifications for painting metal structures, including the appropriate number of applications, will provide a complete contract specification for painting bridges.

### Highlights of Revision

1. Elimination of red lead paint systems from AASHTO. Environmental problems are often encountered with the removal of these systems when repainting becomes necessary.
2. Inclusion of systems calling for vinyl, alkyd, organic zinc, and inorganic zinc paints, which may be used in various climates.
3. Reference to the Steel Structures Painting Council criteria for blast cleaning has been included.
4. We are attaching suggested paint specifications for vinyls, alkyds, organic zinc, and inorganic zinc. These specifications have been forwarded to the Task Force of the AASHTO Subcommittee on Materials that is charged with preparing the final AASHTO Paint Specifications. This task force is chaired by Mr. George Hill of California, and we plan to work closely with him in the development of material specifications.

The suggested paint specifications are not being recommended for ballot, but will be referred to the Materials Committee for approval.

### Pre-Treatment, Vinyl Wash Primer

#### Classification:

This specification covers a wash primer formulated specifically for application prior to painting clean aluminum, galvanized surfaces or surfaces previously coated with an organic or inorganic zinc-rich primer. It is also used on blast cleaned steel when specified and is mandatory as an undercoat under vinyl paint systems.

#### Composition:

Composition.		Resin Component	Pounds per 80 gallons of Resin Component
		Specifications	
Polyvinyl-butyral resin <sup>1</sup> .....	2.....		56
Zinc Chromate (insoluble type).....	2.....		54
Magnesium-silicate.....	(Type A or B MIL-M-15173).....		8
Lampblack.....	(TT-P-350).....		0.6
Butyl Alcohol, normal.....	(TT-B-846).....		125
Ethyl Alcohol.....	(Grade III of O-E-760) <sup>3</sup> .....		380

Acid Component	Pounds per 20 gallons of Acid Component
Phosphoric Acid, 85%.....(Class 1 of O-O-670).....	28
Water.....	25 max.
Ethyl Alcohol.....(Grade III of O-E-760) 3.....	102

<sup>1</sup>The polyvinyl partial butyral resin shall contain only polyvinyl butyral, polyvinyl alcohol and polyvinyl acetate in the molecule, and shall have the following properties:

Polyvinyl alcohol, percent by weight.....	19.0-22.0
Polyvinyl acetate, percent by weight.....	1.0 max.
Inherent viscosity, ASTM Designation: D 1243.....	0.87-0.95
Specific gravity.....	1.10-1.14
Heating loss, 45 minutes at 105°C, percent by weight..	3.0 max.
Ash, percent by weight.....	0.1 max.

<sup>2</sup>The zinc chromate shall be of an insoluble type, showing an analysis 16 to 19 percent CrO<sub>3</sub>, and 67 to 72 percent ZnO, and not more than one percent water soluble salts.

<sup>3</sup>Isopropyl alcohol (99 percent) may be substituted in part for ethyl alcohol on an equal volume basis. The isopropyl alcohol shall have a specific gravity of 0.785 to 0.790 and a distillation range not greater than 1.5°C, and this range shall include 82.3°C.

#### Characteristics of Resin Component:

	Minimum	Maximum
Pigment, percent by weight.....	9.5	10.5
Volatiles, percent by weight.....	80.0	82.0
Non-volatile vehicle, percent by weight (Calculated by difference).....	8.5	9.5
Ratio of pigment to non-volatile vehicle by weight.....	9.7 to 9	10.3 to 9
Coarse particles and skins, as residue retained on standard No. 325 mesh sieve (RR-S-306), percent by weight.....	---	0.5
Viscosity, Krebs units.....	57	67
Weight per gallon, pounds.....	7.2	7.7
Fineness of grind.....	5	---
Chromium oxide (CrO <sub>3</sub> ), percent by weight of pigment.....	14	---
Zinc oxide (ZnO), percent by weight of pigment.....	57	---
Distillation:		
Initial boiling point, °C.....	75	82
Temperature at 80 ml. point, °C.....	---	85
Temperature at 100 ml. point, °C.....	116	---
End point, temperature, °C.....	---	120
Volume at end point, ml. ....	112	---

#### Characteristics of Acid Component:

Phosphoric acid, percent by weight.....	15.0	16.5
Distillation:		
Initial boiling point, °C.....	75	81
Temperature at 105 ml. point, °C.....	---	82
Volume at end point, ml. ....	120	---
Maximum temperature during distillation, °C....	---	102
Weight per gallon, pounds.....	7.5	7.9

#### Characteristics of Mixed Resin and Acid Components:

Dry time, hard, minutes..... 30 max.  
Smooth homogeneous mix, no gelation within 24 hours in closed  
container.

#### Packaging and Labeling:

The label shall state that the primer is to be packaged such that the acid component can be mixed with the resin component in the resin component container. The resin and acid components shall be separately packaged, and the packages shall be of such type as to prevent attack by the components.

The label shall also state that one part by volume of the acid component is to be added slowly with constant stirring to 4 parts by volume of the resin component just before use and that the mixed components must be used within 8 hours. It shall further state that the mixed material is intended for spray application in dry film thicknesses of 0.3- to 0.5-mil.



## Vinyl Primer, Red Iron Oxide Type

### Classification:

This specification covers a ready-mixed vinyl-red iron oxide paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer

This paint should be applied alternately with Vinyl Primer, Red Iron Oxide--Titanium Dioxide to provide a primer coating which may consist of one or more applications of each vinyl primer.

This paint is formulated primarily for spray application.

### Composition:

Pigment Ingredients		
Specifications		Lbs/100 Gals
Red Iron Oxide <sup>1</sup>	.....	51.2
Magnesium Silicate.....TT-P-403.....	.....	7.2
Vehicle Ingredients		
Vinyl Resin <sup>2,2a</sup>	.....	87.2
Vinyl Resin <sup>3,3a</sup>	.....	28.8
Toluene.....TT-T-548.....	.....	109
Normal Butyl Acetate.....TT-B-838.....	.....	500
Di- (2-ethylhexyl Phthalate.....	.....	28.8
Soya Lecithin.....	.....	7.2
Epoxy Resin <sup>4</sup>	.....	0.6

<sup>1</sup>Fe<sub>2</sub>O<sub>3</sub>, 98.5% minimum; oil absorption, 21; fineness through 325 mesh screen, 99% minimum; and specific gravity, 5.15.

<sup>2A</sup> vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of  $0.54 \pm 0.03$  poise at 20°C in cyclohexanone.

<sup>3A</sup> vinyl chloride-vinyl acetate copolymer resin, specific gravity, 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of  $0.52 \pm 0.03$  poise at 20°C in cyclohexanone.

<sup>2aA</sup> vinyl chloride-vinyl acetate copolymer resin with a specific gravity of 1.36; vinyl chloride content of approximately 84%; vinyl acetate content of approximately 16%; inherent viscosity (ASTM Designation: D 1243) of 0.49-0.51.

<sup>3aA</sup> vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.31; inherent viscosity (ASTM Designation: D 1243) of 0.31 to 0.32.

<sup>4</sup>Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25°C, 180-195 epoxide equivalent.

The preparation of this paint in steel ball mills is not acceptable.

Characteristics:

Toluene and Isoketones by volume of volatiles, percent....	19.0 max.
Weight per gallon, in pounds.....	8.0 - 8.4
Pigment by weight of paint, percent.....	6.4 - 8.1
Volatiles by weight of paint, percent.....	73.3-75.3
Fineness of grind, Hegman.....	6 min.
Viscosity, KU.....	61 max.
Drying time: set to touch, hours.....	$\frac{1}{2}$ max.

The components of this paint shall be ground and mixed in a manner which will insure adequate wetting and suspension of the pigment.

Working properties shall be satisfactory.

NOTE: If vinyl resin 2 is used, vinyl resin 3 shall be used. If vinyl resin 2a is used, vinyl resin 3a shall be used.

AD-A093 495

ARTECH CORP FALLS CHURCH VA  
REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS. (U)  
SEP 79 F ORDWAY, M J HAMMELL  
ARTECH-J7600.159-FR

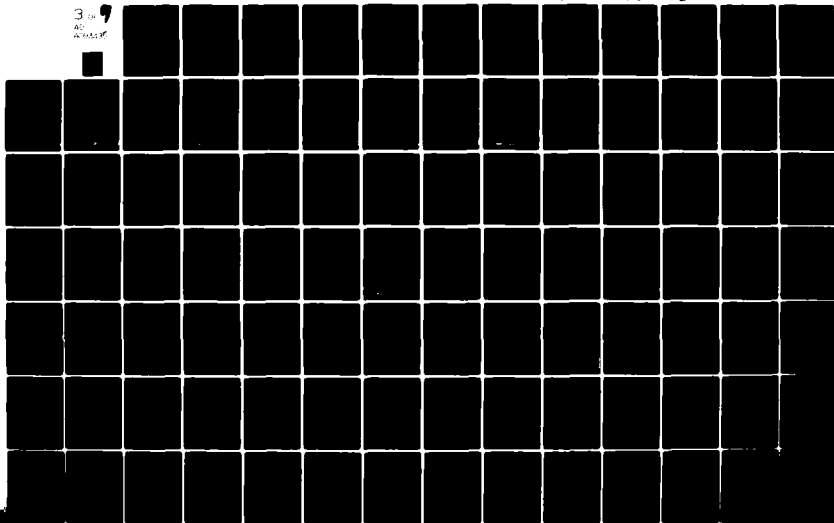
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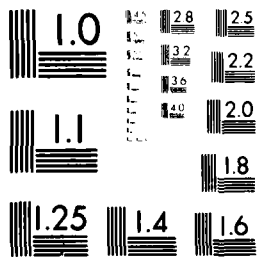
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MICROCOPY RESOLUTION TEST CHART  
NBS 1010-A

## Vinyl Primer, Red Iron Oxide--Titanium Dioxide Type

### Classification:

This specification covers a ready-mixed, vinyl-red iron oxide-titanium dioxide paint, for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer

This paint is formulated primarily for use on steel structures which are located in the coastal zone. This paint should be applied alternately with Vinyl Primer, Red Iron Oxide Type to provide a primer coating which may consist of one or more applications of each vinyl primer.

This paint is formulated primarily for spray application.

### Composition:

Pigment Ingredients		Lbs/100 Gals
Specifications		
Red Iron Oxide <sup>1</sup> .....		19.2
Titanium Dioxide.....	ASTM Designation: D476, Type III or IV.....	39.2
Vehicle Ingredients		
Vinyl Resin <sup>2,2a</sup> .....		87.2
Vinyl Resin <sup>3,3a</sup> .....		28.8
Toluene.....	TT-T-548.....	109
Normal Butyl Acetate.....	TT-B-838.....	498
Di- (2-ethylhexyl) Phthalate.....		28.8
Soya Lecithin.....		7.2
Epoxy Resin <sup>4</sup> .....		0.6
<sup>1</sup> Fe <sub>2</sub> O <sub>3</sub> , 98.5% minimum; oil absorption, 21; fineness through 325 mesh screen, 99% minimum; and specific gravity, 5.15.		
<sup>2A</sup> vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate, and 6% vinyl alcohol with an intrinsic viscosity of 0.54±0.03 poise at 20°C in cyclohexanone.		
<sup>3A</sup> vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.35, containing 86% vinyl chloride, 13% vinyl acetate, and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.52±0.03 poise at 20°C in cyclohexanone.		
<sup>2aA</sup> vinyl chloride-vinyl acetate copolymer resin with a specific gravity of 1.36; vinyl chloride content of approximately 84%; vinyl acetate content of approximately 16%; inherent viscosity (ASTM Designation: D 1243) of 0.49-0.51.		
<sup>3aA</sup> vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.31; inherent viscosity (ASTM Designation: D 1243) of 0.31-0.32.		
<sup>4</sup> Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25°C, 180-195 epoxide equivalent.		

4. The preparation of this paint in steel ball mills is not acceptable.

Characteristics:

Toluene and Isoketones by volume of volatiles, percent....	19.0 max.
Weight per gallon, in pounds.....	8.0 - 8.4
Pigment by weight of paint, percent.....	6.4 - 8.1
Volatiles by weight of paint, percent.....	73.2-75.2
Fineness of grind, Hegman.....	6 min.
Viscosity, KU.....	61 max.
Drying time: set to touch, hours.....	$\frac{1}{2}$ max.

The components of this paint shall be ground and mixed in a manner which will insure adequate wetting and suspension of the pigment.

Working properties shall be satisfactory.

NOTE: If vinyl resin 2 is used, vinyl resin 3 shall be used. If vinyl resin 2a is used, vinyl resin 3a shall be used.

## Zinc-Rich Primer, Organic Vehicle Type

### Description:

This specification covers a one-package, thermoplastic organic zinc-rich primer whose mechanism of drying is that of solvent release. It is intended for use only on blast cleaned open steel structures exposed to the air.

This coating is intended for spray application. Limited application can be made by brushing.

### Composition:

#### Pigment Ingredients (62.3 Percent of Composition Weight, Medium)

Specification	Parts by Weight of Pigment	
	Type I, Red Tint	Type II, Gray
Zinc Dust.....TT-P-460, Type I <sup>1</sup>	95.0 min.	95.0 min.
Red Iron Oxide <sup>2</sup> .....---	1.5 max.	---
Zinc Oxide.....TT-P-463, Type I, Grades A or B	---	1.5 max.
Thixotropes and Additives..---	3.5 max.	3.5 max.

#### Vehicle Ingredients (37.7 Percent of Composition Weight, Maximum)

	Specifications	Parts by Weight
		of Vehicle
Polyaryl Ether <sup>3</sup> .....	---	19.0
Ethylene Glycol Monoethyl Ether Acetate.....	MIL-E-7125	66.8
Toluene.....	TT-T-548	14.2

<sup>1</sup>Except the metallic zinc content shall be 95 percent by weight, minimum.

<sup>2</sup>Fe<sub>2</sub>O<sub>3</sub>, 98.5% minimum; oil absorption, 21; fineness through 325 mesh screen, 99% minimum; and specific gravity, 5.15.

<sup>3</sup>A polyhydroxy polyalkaryl polyether of the following properties:

Specific gravity.....	1.18
Viscosity of 40% solids in methyl ethyl ketone, Brookfield RVF, 20 rpm No. 5 spindle.....	5,500 to 7,700 cps
Reduced viscosity (0.2g/100 ml. dimethylformamide).....	0.4 to 0.6
Ultimate tensile strength.....	9,000 to 9,500 psi
Ultimate tensile elongation.....	50 to 100%
Softening temperature.....	212° F.
Bulking value.....	0.102 gal. per lb.

The average particle size of the pigment shall not exceed 9 microns as determined by the Fisher Sub-Sieve Sizer. The Red Iron Oxide must first be ground into a portion of the vehicle to provide a Hegman grind sufficient to produce the specified color of the finished paint.

The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

#### Infrared Characteristic Curve of Primer Vehicle:

When dried upon a potassium bromide disc, a film of the primer shall have infrared absorption maximums at the same wavelengths and to the same relative degree as that shown by the curve on file.

The composition of the extracted zinc dust pigment shall match the X-ray diffraction curve on file.

The paint shall in addition to the preceding composition conform to the following table of requirements:

#### Characteristics of Paint:

Volatiles at 105°C, percent by weight.....	28-32
Weight per gallon, pounds.....	17.2-18.0
Viscosity, KU at 77°F.....	100-120
Metallic zinc, percent by weight of extracted pigment by Federal Test Method No. 141, Method 7221.....	90.2 min.
Dry time at 77°F, 50% relative humidity, 6 mil wet thickness: Set to touch, hours.....	3/4 max.
Dry hard, hours.....	5 max.
Storage life, years.....	1 min.

#### Properties of Cured Coating:

When applied to a plate glass panel with a 6 mil gap clearance doctor blade and cured for 15 days at 77° + 5°F and 50 + 5% relative humidity, the coating shall have the following properties:

Pencil Hardness.....	B min.
Color (for Type I only).....	Not Lighter Than Standard Color

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on blast cleaned steel having an anchor profile pattern of one to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by blast cleaning to produce a one to 1.5 mil anchor pattern, and cured for 15 days at a relative humidity of 50 + 5% and tested according to the Conica. Mandril Test, Federal Test Method Standard No. 141, Method 6222, there shall be no loosening of the film above the point of the longest continuous crack.



When a steel panel is blast cleaned to white metal and coated with 3-4 mils dry film thickness of this coating and cured for 15 days at  $75^{\circ} \pm 2^{\circ}\text{F}$  and  $50 \pm 5\%$  relative humidity and diagonally scribed to expose bare steel, there shall be no underfilm corrosion on the surface of the panel extending beyond the scribed lines after 1,000 hours when tested according to ASTM Designation: B 117.

Prior to use, the paint shall be thinned with not more than one volume of thinner to 4 volumes of paint using a power agitated stirrer. The thinner shall consist of a mixture of 82 percent by volume of ethylene glycol monoethyl ether acetate and 18 percent by volume of toluene.

## Inorganic Zinc

### Description:

This specification covers a 2-component self-curing ethyl silicate vehicle type zinc silicate paint which, when mixed and applied in accordance with specification requirements, shall cure without the use of a separate curing solution to a coating having the properties described herein.

### Composition:

#### Component A Pigment Composition

The pigment shall consist of a finely divided zinc powder containing a minimum of 95 percent metallic zinc and 98 percent total zinc by weight using Federal Test Method Standard No. 141, Method 7221. The average particle size shall not exceed 9.0 microns as determined by the Fisher Sub-Sieve Sizer. The pigment shall have a specific gravity of not less than 7.00 nor more than 7.14 as determined using the procedure set forth in ASTM Designation: D 153.

#### Component B Partially Hydrolyzed Ethyl Silicate Vehicle

The ethyl silicate used in the hydrolysis reaction in the preparation of the vehicle shall contain at least 40 percent silicon dioxide.

### Vehicle Composition:

For First Coat Work on Blast Cleaned Steel, pyrazolone red, a dry pigment, shall be dispersed in the vehicle at the rate of 0.5-percent of the weight of the vehicle. It shall be so dispersed as to yield a grind of 6 Hegman, minimum. The vehicle without pigment shall have the following composition.

	Parts by Weight
Ethyl Silicate, 40% SiO <sub>2</sub> content.....	27.7
Polyvinylbutyral resin, to correspond to the resin used in Federal Specification MIL-P-15328.....	5.5
Secondary Butyl Alcohol TT-B-848.....	42.6
Cyclohexanone.....	5.4
1, 1, 2-Trichloroethane.....	5.5
2-Nitro Propane.....	5.5
Diocetyl Sodium Sulfosuccinate, solution in normal Propyl Alcohol of a 75% solution in distilled water.....	0.4
Hydrochloric Acid, 0.25% solution of Hydrogen Chloride Gas.....	2.9
Normal Propanol.....	4.5

### Vehicle Properties:

Non-volatile at 105°C, percent by weight.....	23.0-25.0
Viscosity, Brookfield, Model RVT, No. 1 spindle at 50 rpm, poises.....	0.85-1.50
Weight per gallon, pounds, at 77°F.....	7.6-7.8
Silicon dioxide equivalent.....	10.8 min.
Storage life at 77°F, months.....	6 min.
Viscosity at 77°F, after 72 hours at 140°F, Brookfield Model RVT, No. 1 spindle at 50 rpm, poises.....	1.85 max.
pH of vehicle, Hydrion paper.....	2-5

### Mixed Paint Properties:

The zinc dust shall be mixed with the vehicle in the ratio of 13.5 pounds per gallon of vehicle just before use. The mixed paint shall have the following properties:

Weight per gallon at 77°F, pounds.....	17.2 min.
Viscosity, KU at 77°F.....	70-80
Viscosity, KU at 77°F, after 24 hours.....	80 max.
Non-volatile at 105°C, percent by weight.....	72.0 min.
Dry time at 77°F, and 50% relative humidity, 6-mil doctor blade clearance	
Set to touch, hours.....	$\frac{1}{2}$ max.
Dry hard, hours.....	2 max.

Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating.

### Properties of Cured Coating:

When applied to plate glass panel with a 6-mil gap doctor blade and cured for 15 days at a relative humidity of 95-100 percent, the coating shall have a pencil hardness greater than H.

When a steel panel is sandblasted to white metal and coated with not less than a 3- nor more than a 4-mil dry film thickness of this coating and cured for 7 days at 50 percent  $\pm$  5 percent relative humidity and diagonally scribed to expose bare steel, there shall be no corrosion on the surface of the coated panel after 3,000 hours when tested according to ASTM Designation: B 117.

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on sandblasted steel having an anchor profile pattern of one to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by sandblasting to produce a one to 1.5-mil anchor pattern, and cured for 15 days at a relative humidity of 50 percent  $\pm$  5 percent and tested according to the Conical Mandril Test, Federal

Test Method Standard No. 141, Method 6222, the minimum elongation shall be 10 percent. There shall be no loosening of the film above the point of the longest continuous crack.

**Packaging and Labeling:**

The label for the zinc silicate paint shall state that containers of unused material must be kept tightly sealed, and the paint must be used within 12 hours from the time it was mixed when the temperature does not exceed 77°F; between 77°F and 90°F the paint shall be used within 6 hours and at temperatures above 90°F it shall be used within 4 hours. The sealed containers of mixed paint not used within the above time limits shall be opened and the paint discarded. Complete instructions for use shall be included with each container of paint.

The paint shall be packaged so that one unit of the pigment shall be mixed with one unit of the vehicle. The lining of the vehicle containers shall be of a type that will prevent attack of the container.

### White Tint Base Vinyl Finish Coat

#### Classification:

This specification covers a ready-mixed white tint base vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer

This paint is formulated primarily for spray application.

#### Composition:

Pigment Ingredients Specifications		Lbs/100 Gals
Titanium Dioxide.....	ASTM Designation: D 476, Type III or IV.....	72.7
Vehicle Ingredients		
Vinyl Resin <sup>1,1a</sup> .....		87.2
Vinyl Resin <sup>2,2a</sup> .....		28.8
Toluene.....	TT-T-548.....	109
Normal Butyl Acetate.....	TT-B-838.....	495
Di- (2-ethylhexyl) Phthalate.....		28.8
Soya Lecithin.....		7.2
Epoxy Resin <sup>3</sup> .....		0.6

When light to medium tints are specified, not over 30 percent by weight of the titanium dioxide may be replaced by an equal weight of the light-fast tinting pigments.

<sup>1</sup>A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of  $0.54 \pm 0.03$  poise at 20°C in cyclohexanone.

<sup>2</sup>A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymers of dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of  $0.52 \pm 0.03$  poise at 20°C in cyclohexanone.

<sup>1a</sup>A vinyl chloride-vinyl acetate copolymer resin with a specific gravity of 1.36; vinyl chloride content of approximately 84%; vinyl acetate content of approximately 16%; inherent viscosity (ASTM Designation: D 1243) of 0.49-0.51.

<sup>2a</sup>A vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.31; inherent viscosity (ASTM Designation: D 1243) of 0.31-0.32.

<sup>3</sup>Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25°C, 180-195 epoxide equivalent.

The preparation of this paint in steel ball mills is not acceptable.

Characteristics of Tinted Paint:

Toluene and Isoketones by volume of volatiles, percent, maximum.....	19.0
Weight per gallon, in pounds.....	8.1-8.5
Pigment by weight of paint, percent.....	8.0-10.1
Volatiles by weight of paint, percent.....	71.0-73.8
Viscosity, KU, maximum.....	61
Fineness of grind, Hegman, Minimum.....	6
Drying time: set to touch, hours maximum.....	$\frac{1}{2}$

The sprayed paint film shall exhibit uniform color and appearance and show no evidence of flooding, floating, or silking.

Working properties shall be satisfactory.

The label on each container shall bear the legend, "For spray application only, not suitable for brush application."

NOTE: If vinyl resin 1 is used, vinyl resin 2 shall be used. If vinyl resin 1a is used, vinyl resin 2a shall be used.

### Green Finish Coat

The following is included as an example of an Alkyd paint finish. The green color is optional.

#### Classification:

This specification covers a ready-mixed green paint suitable for use as a finish coat on properly prepared structural steel surfaces. This paint may be applied by spray or brush.

#### Composition:

Pigment Ingredients		
	Specifications	lbs/100 Gals
Titanium Dioxide.....	ASTM Designation: D 476, Type III or IV.....	29.3
Phthalocyanine Green.....		17.0
Chrome Oxide Green.....	TT-P-347.....	137.7
Vehicle Ingredients		
Alkyd Resin.....	TT-R-266, Type III.....	525.4 <sup>1</sup>
Mineral Spirits.....	TT-T-291E, Type II, Grade A.....	174.5 <sup>2</sup>
Driers.....	TT-D-643.....	

<sup>1</sup>This quantity based on 50% non-volatile.

<sup>2</sup>A maximum of 10 percent of the mineral spirits may be replaced with ethyl benzene for viscosity adjustments.

#### Characteristics:

Weight per gallon, in pounds.....	8.8 min.
Pigment by weight of paint, percent.....	20.8 min.
Volatiles by weight of paint, percent.....	49.3 max.
Fineness of grind, Hegman.....	7 min.
Viscosity, KU.....	62-68 <sup>3</sup>
Drying time: set to touch, hours.....	2 max.
set for recoating, hours.....	8 max.
Skimming: none after 48 hours in a 3/4 full sealed container.	
Color:	

There shall be no objectionable odor.

Working properties shall be satisfactory.

<sup>3</sup>Viscosity range shall be maintained on storage.

FEDERAL SPECIFICATION  
PRIMER COATING, ZINC DUST-ZINC OXIDE  
(FOR GALVANIZED SURFACES)

This amendment, which forms a part of Federal Specification TT-P-641G, dated July 9, 1976, was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

PAGE 3

Paragraph 3.2. Delete:

Chrome green (c.p.) and Chrome yellow (c.p.)

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Table III. At end of table III, add under characteristics: "Lead, percent nonvolatile"; under minimum for Types I, II and III, add "\_\_\_"; and under maximum for Types I, II and III, add "0.06".

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Add new paragraphs:

4.3.7 Lead content.

4.3.7.1 Sample preparation. Using a 0.006-inch film applicator and a mechanical applicator plate, duplicate drawdowns for each sample of well-mixed paint shall be made on a standard paint penetration chart and dried for 24 hours. The drawdown shall be at least 10 inches long on the sealed portion of the penetration chart. The drawdown shall be cut into discs of appropriate size to fit the sample holder of a fluorescence X-ray spectrometer.

4.3.7.2 Procedure. Lead content shall be determined using an X-ray fluorescence spectrometer capable of determining lead content at a minimum level of 0.03 percent by weight of the total nonvolatile. The settings for a wavelength dispersive fluorescence spectrometer shall be as follows: (1)

Element	Analytical Line	Angle	Crystal	Detection	Collimator	X-ray tube (NO)
Pb	L	33.93	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Pb (backgrd I)		33.00	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Pb (backgrd II)		35.50	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Mo	K	20.33	LiF(200)	Flow S.C.	Fine	60Kv 45Ma

Pulse height selection shall be used in all measurements and counting time shall be 100 seconds. Place the sample disc in the wavelength dispersive unit. Measure the count rates of lead, lead background, and the Molybdenum Compton scattered background from the X-ray tube.

4.3.7.3 Calculation.

$$R = \frac{I_{Pb} - \frac{I_{Pb} \text{ (Background I)} + I_{Pb} \text{ (Background II)}}{2}}{I_{Mo}}$$

(1) Energy dispersive fluorescence spectrometers shall be set up according to the manufacturer's manual.

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where I equals gross intensity. These results shall be compared to those obtained with a 0.06 percent lead standard made up from the same type of paint sample and evaluated for compliance with table III.

FEDERAL SPECIFICATION

PRIMER COATING; ZINC DUST-ZINC OXIDE  
(FOR GALVANIZED SURFACES)

This specification was approved by the Commissioner,  
Federal Supply Service, General Services Administration,  
for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION:

1.1 Scope. This specification covers a ready-to-mix or preprepared primer for  
on galvanized metal surfaces. The primers covered by this specification are not intended  
for use on the inside of drinking water tanks.

1.2 Classification.

1.2.1 Types. Zinc dust-zinc oxide primer covered by this specification shall be of  
the following types, as specified (see 6.2 and 6.3).

- Type I - Zinc dust-zinc oxide linseed oil primer.
- II - Zinc dust-zinc oxide-phthalic alkyd resin primer.
- III - Zinc dust-zinc oxide-phenolic resin primer.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids  
or request for proposal, form a part of this specification to the extent specified  
herein.

Federal Specifications:

- TT-L-190 - Linseed Oil, Boiled, (For Use in Organic Coatings).
- TT-R-266 - Resin, Alkyd; Solutions.
- TT-R-271 - Resin, Phenol-Formaldehyde, Para-Phenyl.
- TT-T-291 - Thinner: Paint, Volatile Spirits (Petroleum-Spirits).
- TT-T-306 - Thinner; Synthetic Resin Enamel.
- TT-T-775 - Tung Oil, Raw (China Wood) (For Use in Organic Coating).
- PPP-B-601 - Boxes, Wood, Cleated-Plywood.
- PPP-B-621 - Boxes, Wood, Nailed and Lock Corner.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-B-640 - Boxes, Fiberboard, Corrugated, Triple-Wall.
- PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
- PPP-F-320 - Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and  
Cut Shapes.
- PPP-P-704 - Pails, Metal: Shipping, Steel, 1 through 12 Gallon.

Federal Standards:

- Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).
- Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer, and Related Materials;  
Methods of Inspection, Sampling, and Testing.

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(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

- D 79 - Standard Specification for Zinc Oxide.
- D 185 - Test for Coarse Particles in Pigments, Pastes, and Paints.
- D 520 - Standard Specification for Zinc Dust (Metallic Zinc Powder).
- D 562 - Test for Consistency Using the Stormer Viscosimeter.
- D 563 - Test for Phthalic Anhydride Content of Alkyd Resins and Resin Solutions.
- D 1296 - Test for Residual Odor of Lacquer, Solvents and Diluents.
- D 1475 - Test for Density of Paint, Varnish, Lacquer, and Related Products.
- D 1542 - Qualitative Tests for Rosin in Varnishes.
- D 1639 - Test for Acid Value of Organic Coating Materials.
- D 1642 - Tests for Elasticity or Toughness of Varnishes.
- D 1959 - Test for Iodine Value of Drying Oils and Fatty Acids.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., Tariff Order Section, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

### 3. REQUIREMENTS

3.1 General. The primer ingredients shall be furnished in two separate containers; one consisting of a liquid (zinc oxide-vehicle) and the other of zinc dust which is to be added to the zinc oxide-vehicle just prior to use. When the entire amount of zinc dust from one container is mixed with all of the zinc oxide-vehicle from another container, as described in 4.3.1, a primer, conforming to all requirements of this specification, shall result.

3.2 Color. The primer shall be of a gray color characteristic of the composition, unless otherwise specified by the buyer. If other colors are desired (reds, greens, buffs, etc.), the following coloring materials or any combination of them in amounts necessary to produce the required color primer will be permitted up to a maximum of 10 percent based on the total pigment to replace an equal weight of the zinc oxide:

Iron oxide (at least 80 percent  $Fe_2O_3$ )  
Chrome green (c.p.)  
Chromium oxide green (c.p.)  
Chrome yellow (c.p.)  
Burnt umber  
Zinc chromate yellow

The buyer may specify from the above list any specific coloring materials that shall be used in producing the desired primer. The color, when specified, shall match a sample mutually agreed upon by the buyer and seller, when tested as specified in table V.

3.3 Condition of zinc oxide-vehicle in container. The zinc oxide-vehicle shall be thoroughly mixed and ground. It shall not be settled, caked, or thickened to such a degree that it cannot be redispersed easily with a paddle to its original condition. It shall be readily incorporated with the zinc dust to form a primer of good brushing consistency when tested as specified in table V.

3.4 Pigment. The pigment composition in the mixed primer (except when colors other than gray are specified, see 3.2) shall be in accordance with table I (see 6.7).

TABLE I. Pigment

Ingredients	Percent by weight	
	Minimum	Maximum
Zinc dust (ASTM D 520, Type I).....	79	89
Zinc oxide (ASTM D 79, American Process Lead Free).....	19	21

3.4.1 Upon analysis, the zinc dust shall show not less than 94 percent metallic zinc by weight. The pigment, extracted from the zinc oxide-vehicle and ignited, shall show on analysis not less than 98 percent zinc oxide by weight. The total pigment (zinc dust plus zinc oxide) in the mixed primer shall contain a minimum of 74 percent metallic zinc and a minimum of 18 percent zinc oxide by weight. The sum of the percentages by weight of metallic zinc and zinc oxide in the total pigment of the mixed primer shall be not less than 97.

### 3.5 Vehicles.

#### 3.5.1 Type I (zinc dust-zinc oxide-linseed oil primer).

3.5.1.1 Composition. The vehicle shall consist of the ingredients in table II.

TABLE II. Vehicle

Ingredients*	Percent by weight	
	Minimum	Maximum
Raw linseed oil.....	89	91
Thinner and drier.....	9	11

\*Antiskinning agents may be present.

3.5.1.1.1. Volatile solvent. The volatile solvent used shall be mineral spirits conforming to TT-T-291, type II or any solvent system complying with the following air pollution regulations by volume when tested as specified in 4.3.6.

- a. Aromatic compounds with eight or more carbon atoms except ethylbenzene: 8 percent maximum.
- b. Ethylbenzene and toluene: 20 percent maximum.
- c. Solvents with an olefinic or cyclo-olefinic type of unsaturation: negative test.
- d. Ketones: negative test.
- e. Total of a & b: 20 percent maximum.

3.5.1.1.2. Nonvolatile. The vehicle shall contain not less than 89 percent, nor more than 91 percent, nonvolatile matter by weight when tested as specified in table V.

3.5.1.2 Acid number. The acid number of the combined vehicle shall not exceed 4 when tested as specified in table V.

3.5.1.3. Iodine number (Wijs). The fatty acids prepared from the nonvolatile vehicle of the primer shall have an iodine number of not less than 175 when tested as specified in table V.

3.5.1.4. Unsaponifiable matter. There shall be no unsaponifiable matter present in the fatty acids prepared from the nonvolatile vehicle of the primer when tested as specified in table V.

### 3.5.2. Type II (Zinc dust-zinc oxide-phthalic alkyd resin primer).

3.5.2.1. Composition. The vehicle shall consist of a long oil, linseed-modified phthalic alkyd resin of the air-drying type, conforming to the requirements of TT-R-266, type II, together with suitable driers. Antiskinning agents and suitable driers may be present.

3.5.2.1.1 Volatile solvent. The volatile solvent used shall be mineral spirits conforming to TT-T-291, type II or any solvent system complying with the air pollution regulations by volume as given in 3.5.1.1.1.

3.5.2.1.2. Nonvolatile. The vehicle shall contain not less than 43 percent nonvolatile matter by weight when tested as specified in table V.

3.5.2.2 Phthalic anhydride. The nonvolatile portion of the vehicle shall contain not less than 23 percent phthalic anhydride by weight when tested as specified in table V.

3.5.2.3 Rosin or rosin derivatives. The vehicle shall contain no rosin or rosin derivatives when tested as specified in table V.

### 3.5.3 Type III (Zinc dust-zinc oxide-phenolic resin primer).

3.5.3.1. Composition. The vehicle shall consist of 100 percent phenolic resin spar varnish, suitable for grinding with zinc oxide, and shall have an oil-to-resin ratio of approximately 2 to 1 by weight. That is, it shall be 25 gallons in length composed of 25 gallons of vegetable drying oil to 100 pounds of phenol-formaldehyde resin, and driers.

3.5.3.1.1. Resin. The resin shall be 100 percent paraphenyl phenol-formaldehyde resin of the fortifying type, meeting the requirements of TT-R-271.

3.5.3.1.2 Oils. The vegetable oils shall consist of equal parts by volume of tung oil meeting the requirements of TT-T-775 and linseed oil conforming to TT-L-190.

3.5.3.1.3 Volatile solvent. The volatile solvent used shall be any solvent system complying with the air pollution regulations by volume as given in 3.5.1.1.1. Antiskinning agents may be present.

3.5.3.1.4 Nonvolatile. The vehicle shall contain not less than 50 percent solids by weight when tested as specified in table V.

3.5.3.2 Resin - pentaerythritol ester. The vehicle shall pass an 80 percent resin pentaerythritol ester reduction test when tested as specified in table V.

3.5.3.3 Water resistance. A flow-out film of the vehicle on tinplate, air-dried 48 hours, shall withstand immersion in distilled water for 24 hours at temperature of 20 to 30°C (68 to 86°F) and also (separate panel) 6 hours at 75 ± 2°C (167 ± 5°F). It shall show no checking, blistering, or whitening, and only slight dulling when observed 5 minutes after removal from water when tested as specified in table V.

3.5.3.4 Resin and resin derivatives. The vehicle shall contain no resin or resin derivatives when tested as specified in table V.

### 3.6 Mixed primer.

3.6.1 Odor. The odor shall be normal for the volatiles permitted by the specification, when tested as specified in table V.

3.6.2 Miscibility with mineral spirits. The primer shall be completely miscible with mineral spirits conforming to grade II of TT-T-291, when tested as specified in 4.3.2.

3.6.3 Brushing properties. The primer shall show good brushing and leveling properties, and shall dry with a low gloss (eggshell to semigloss) finish without running, streaking or sagging, when applied as specified in 4.3.3.

3.6.4 Spraying properties. The primer shall spray satisfactorily in all respects when thinned with no more than one part by volume of mineral spirits conforming to grade II of TT-T-291, to eight parts of the mixed primer when tested as specified in table V.

3.6.5 Flexibility. A film of the primer shall show no cracking when prepared, bent, and examined as specified in 4.3.4.

3.6.6 Adhesion. A film of the primer shall adhere to, and shall not flake or crack from the metal when tested as specified in 4.3.5.

3.6.7 Skinning. The primer shall not skin within 48 hours at 25°C (77°F) in a three-quarter filled closed container when tested as specified in table V.

3.6.8 Quantitative requirements. The mixed primer shall meet the quantitative requirements of table III.

TABLE III. Quantitative requirements of primer

Characteristics	Type I		Type II		Type III	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment, percent by weight of primer	78	81	62	65	64	67
Water, percent by weight of primer	--	0.1	--	0.1	--	0.1
Coarse particles and skins (residue retained on No. 325 standard sieve), percent by weight of pigment	--	4	--	4	--	4
Consistency, Krebs-Stormer, shearing rate 200 r.p.m.						
Grams	200	325	125	225	150	275
Equivalent KU	82	98	67	86	72	92
Time to set to touch, hours	--	--	1/2	4	1/2	4
Time to dry, hours	--	18	--	18	--	18
Weight per gallons, pounds	23	--	16	--	16.4	--

#### 4. QUALITY ASSURANCE PROVISIONS

**4.1 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

#### 4.2 Sampling and inspection.

**4.2.1 Lot.** For the purposes of sampling, a lot of the paint shall consist of a manufacturer's batch. A batch is defined as the end product of all raw materials mixed, blended, or processed in a single operation.

**4.2.2 Sampling for inspection of filled containers.** A random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level I and acceptable quality level (AQL) 2.5 percent defective to verify compliance with this specification regarding fill, closure, and marking and other requirements not involving tests.

**4.2.3 Inspection of containers.** Each sample filled container shall be examined for defects of construction of the container and the closure, for evidence of leakage, and for unsatisfactory markings; each filled container shall also be weighed to determine the amount of contents. Any container in the sample having one or more defects or under required fill shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected.

**4.2.4 Inspection of preparation for delivery requirements.** An inspection shall be made to determine that the packaging, packing, and marking comply with the requirements of section 5 of this specification. Defects shall be scored in accordance with table IV. For examination of interior packaging the sample unit shall be one shipping container fully prepared for delivery. Sampling shall be in accordance with MIL-STD-105. Defects of closure listed shall be examined on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 and the AQL shall be 4.0 defects per hundred units.

TABLE IV. Classification of preparation for delivery defects

Examine	Defects
Markings (exterior and interior)	Omitted; improper size, location, sequence, or method of application.
Materials	Any component missing or damaged.
Workmanship	Inadequate application of components such as incomplete closure of container flaps, loose strapping, inadequate stapling. Bulging or distortion of container.

**4.2.5 Testing of the end item.** The methods of testing specified in 4.4 shall be followed. For purposes of sampling, the lot shall be expressed in units of gallons of paint. The sample unit for testing shall be one gallon of paint, randomly selected from containers in the lot. The paint shall be placed in separate clean, dry containers, sealed, marked, and forwarded to the testing laboratories. The sample size shall be as follows;

Lot size (gallon)	Sample size
800 or less	2
801 up to and including 22,000	3
22,001 and more	5

Tests shall be performed on a sample unit basis. All test reports shall contain the individual values utilized in expressing the final result. The lot shall be unacceptable if one or more sample unit fails to meet any test requirement specified.

4.3 Test procedures. The primer shall be tested in accordance with the applicable test methods indicated in table V, and as specified hereinafter. Alternate test techniques and equipment may be used, but in case of dispute, the test methods specified here shall prevail. Failure of any sample to pass any test, or noncompliance with the requirements of this specification shall be cause for rejection of the lot represented by the sample. Unless otherwise specified all samples shall be prepared and tested at  $23 \pm 1^\circ\text{C}$  ( $73 \pm 2^\circ\text{F}$ ) and  $50 \pm 5$  percent relative humidity.

TABLE V. Index

	Paragraph of this specification giving requirements	Applicable method in Fed. Test Method Std. No. 141	Applicable ASTM Method
Condition in container	3.3	3011	--
Skinning	3.6.7	3021	--
Color	3.2 (1)	4250	--
Spraying properties	3.6.4	4331	--
Odor	3.6.1	----	D1296
Rosin	3.5.2.3, 3.5.3.4 (2)	----	D1542; Sec 4
Water resistance	3.5.3.3	5011	--
Weight per gallon	Table III	----	D1475
Percentage of pigment	Table III	4021	--
Nonvolatile vehicle (ordinary centrifuge)	3.5.1.1.2, 3.5.2.1.2, 3.5.3.1.4	4051	--
Drying time	Table III	4061	--
Water	Table III	4081	--
Coarse particles and skins	Table III	----	D185; Sec 6
Rosin pentaerythritol ester reduction	3.5.3.2	----	D1642; Sec A
Consistency	Table III	----	D562
Unsaponifiable matter	3.5.1.4	5041	--
Iodine number	3.5.1.3	----	D1959
Acid number	3.5.1.2	----	D1639
Para-phenyl resin	3.5.3.1.1	5141	--
Phthalic anhydride	3.5.2.2	----	D563

(1) Brush the primer on a clean tin or glass panel and allow to dry for 24 hours.

(2) Make the test on a portion of the nonvolatile vehicle separated as in method 4031 of Fed. Test Method Std. No. 141.

4.3.1 Mixing zinc dust and zinc oxide-vehicle. The net weight of both the zinc dust and the zinc oxide-vehicle shall be obtained on the original package as received. Weigh each package as received, empty the contents into another container, wipe clean and weigh. This weight subtracted from the weight of the original package gives the net weight of the contents. It is not necessary to mix the entire amount of zinc dust and zinc oxide-vehicle received, but the amount mixed shall be in the exact proportion of the new weights obtained. For mixing less than the entire amount, weigh the exact proportion of zinc dust and zinc oxide-vehicle, to yield the amount of mixed primer desired, in separate containers. Add a small portion of the zinc oxide-vehicle to the zinc dust and mix to a smooth paste, after which the balance is added and thoroughly mixed. Determine compliance with 3.1 before mixing, and retain a small sample of zinc dust and zinc oxide-vehicle in separate, stoppered glass vials for pigment analysis.

4.3.2 Miscibility with mineral spirits. Mix thoroughly one part by volume of mineral spirits, conforming to grade II of TT-T-291, with eight parts by volume of the primer by slowly adding the mineral spirits to the primer and stirring constantly. Allow to stand for 24 hours and examine for curdling or precipitation of the vehicle. Settling of the pigment shall be disregarded. Determine compliance with 3.6.2.



4.3.3 Brushing properties. Brush the well-mixed primer on a clean, untreated, galvanized iron panel, 30 by 60 cm (12 by 24 inches). Note whether the primer works satisfactorily under the brush. Place the panel in a nearly vertical position in a well-ventilated room at standard conditions, and allow to dry over-night. The primer shall dry to a smooth film and shall show no running, streaking, or sagging. Determine compliance with 3.6.3.

4.3.4 Flexibility. Apply a film of the primer to a flat, tin panel (method 2012 of Fed. Test Method Std 141) with a 0.051mm (0.002 inch) approximately 0.10mm (0.004-inch) gap clearance) bird film applicator or any other doctor blade which produces a film of the same thickness as that produced by the Bird blade. Air dry for 18 hours, at standard conditions, then bake for 24 hours at  $105 \pm 10^\circ\text{C}$  ( $220 \pm 20^\circ\text{F}$ ), bend double over a 1/8-inch mandrel, and examine. Determine compliance with 3.6.5.

4.3.5 Adhesion. Brush a coat of the primer on a clean, new galvanized iron panel, 3 by 6 inches air-dry for 18 hours, bake for 3 hours at  $121 \pm 3^\circ\text{C}$  ( $250 \pm 5^\circ\text{F}$ ), and cool to room temperature. Test the film with a knife blade. Observe whether the film cuts loose in the form of a ribbon without flaking or otherwise loosening from the panel. Determine compliance with 3.6.6.

#### 4.3.6 Solvent analysis.

4.3.6.1 Separation of volatile portion. Pour about 15 grams of the primer into a 50 ml distilling flask. Add 10 ml of tricresyl phosphate and several anti-bumping stones or Berl saddles. Fit a release valve into the mouth of the flask and attach a delivery tube to the side arm, extending into a receiver. The receiver consists of a test tube (20 x 150 mm) with side arm for attaching to a vacuum pump. The glass delivery tube should reach 38 mm (1-1/2 inch) from the bottom of the tube. Immerse the receiver in a dry ice-acetone bath. Reduce the pressure slowly to 10 mm of mercury. Preheat a silicone oil bath to  $180 \pm 1^\circ\text{C}$  ( $355 \pm 2^\circ\text{F}$ ). Raise the oil bath until the oil reaches the sample level. After all solvent has distilled, carefully release the vacuum using the valve that is connected to the distilling flask. Reserve the collected distillate for the aromatic solvent determination and the test for ketone, olefinic and cyclo-olefinic compounds.

#### 4.3.6.2 Determination of aromatic hydrocarbons.

Apparatus: A gas chromatograph equipped with a thermal conductivity detector.

Column Preparation: Two lengths of 6.25 mm of (1/4-inch) stainless steel tubing, 1.83 m (6 ft) and 5.48 m (18 ft) long, are packed with 35 percent N,N-bis(2-cyanoethyl) formamide on 60- to 80-mesh Chromosorb P.

Operating Conditions:	1.83m	5.48m
Detector cell temperature, °C	300	300
Detector cell current, ma	150	150
Injection port temperature, °C	300	300
Helium flow at exit, cc/minute	175	110
Column temperature, °C	125	70

4.3.6.2.1 Aromatic and oxygenated solvents - procedure A. Install the 1.83 m column and follow the operating conditions described above. Inject about 3 microliters of the isolated distillate and scan the chromatogram. The aliphatic solvents will emerge within 1 minute and the complete chromatogram should develop in about 5 minutes. From the position of the peaks observed on the chromatogram, select an internal standard that will be free of interference, such as cyclopentanol or cyclohexanol. Add 0.6 ml of internal standard to 3 ml of the distillate, analyze according to the above procedure. Peaks emerging after 1 minute are aromatic solvents along with any oxygenated solvents that may be present. Calculate the percent of aromatic and oxygenated solvents as follows:

$$\text{Percent aromatic and oxygenated solvents, v/v} = \frac{A \times B}{C \times D}$$

where, A = percent of internal standard added (in this case, 20)  
 B = area of aromatic and oxygenated solvents.  
 C = Calibration factor for the internal standard. This factor is dependent on the internal standard used and on the performance of the chromatograph, and should be determined daily.  
 D = Area of the internal standard (in this case, cyclopentanol or cyclohexanol).

NOTE: If the above determination exceeds 8 percent, continue with the following procedure:

4.3.6.2.2 Total aromatic content - procedure B. Place 5 ml of the distillate in a 10 ml glass stoppered graduate. Add 5 ml of 85 percent sulfuric acid slowly while the graduate is being cooled with tap water. After the acid has been added, shake vigorously for 2 minutes then allow the layers to separate. Remove as much of the top layer as possible and wash with distilled water. Carefully pipet 3 ml of the washed solvent into a small flask followed by 0.6 ml of the internal standard. Mix and analyze according to procedure A. Calculate the percent of aromatics after acid treatment in the same manner as in procedure A and the percent of total aromatic solvents as follows:

$$\text{Percent total aromatic solvents, v/v} = \frac{B \times (100-A)}{100-B}$$

where, A = percent of aromatic and oxygenated solvents from procedure A.  
 B = percent of aromatic solvents after acid treatment.

NOTE: If the total aromatic content of the solvent is between 8 percent and 20 percent continue with the following procedure:

4.3.6.2.3 Toluene and ethylbenzene - procedure C. Install the 5.48 m column and follow the operating conditions described for that column. Add 0.3 ml of high purity benzene to the 3 ml sample used in procedure A. If the results of procedures A and B indicated the presence of oxygenated solvents, treat this sample with 85 percent sulfuric acid (use 3 ml acid) as described in procedure B. Inject about 3 microliters of sample and allow the chromatograph to develop until all of the xylene isomers appear. Purge that column by raising the column temperature to  $120 \pm 1^\circ\text{C}$  ( $248 \pm 2^\circ\text{F}$ ). After the high boiling materials emerge reset the column temperature to  $70 \pm 1^\circ\text{C}$  ( $176 \pm 2^\circ\text{F}$ ). Calculate the percent of toluene and ethylbenzene as follows:

$$\text{Percent toluene, v/v} = \frac{A \times B \times C}{D}$$

$$\text{percent ethylbenzene, v/v} = \frac{E \times B \times C}{D}$$

where: A = area of the toluene peak  
 B = calibration factor for the internal standard. This factor is dependent on the internal standard used and on the performance of the chromatograph, and should be determined daily.  
 C = percentage of internal standard added (in this case, 10)  
 D = area of the internal standard (in this case, benzene).  
 E = area of the ethylbenzene peak.

NOTE: Sensitivity of the instrument should be adjusted to keep peaks from running off-scale. Appropriate corrections must be made for changes in sensitivity when computing the peak area.

4.3.6.3 Test for olefinic or cyclo-olefinic compounds. Take 2 test tubes and place 2 drops of the distillate in each. Dissolve the first sample in 1 ml of carbon tetrachloride and add 1 drop of 1 percent bromine in carbon tetrachloride. Shake and allow to sit for 5 minutes. A positive test is indicated by the complete absence of yellow color when observed against a white background. Dissolve the second sample in 1 ml of acetone and add 1 drop of 1 percent permanganate solution (1 gram of potassium permanganate crystals in 95 ml of acetone and 5 ml of water). Shake and allow to sit for 2 minutes. A positive test is indicated by the decolorization of the purple solution. The solvent is considered to fail the test for olefinic or cyclo-olefinic compounds if either of the above tests is positive (see 3.5.1.1.1).

4.3.6.4 Test for ketones.

4.3.6.4.1. Reagent. Mix carefully 2 grams of 2, 4-dinitrophenylhydrazine, 4 ml of concentrated sulfuric acid, 30 ml of methanol, and 10 ml of water.

4.3.6.4.2. Procedure. Pipet 1 ml of reagent into a small test tube. Add 10 drops of distillate and shake for 30 seconds. A yellow precipitate or cloud in the reagent layer indicates the presence of ketones. Run a blank using one milliliter of reagent and 10 drops of mineral spirits. Check for conformance of solvent composition with 3.5.1.1.1.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A, B, or C, as specified (See 6.2).

5.1.1 Level A. The primer ingredients furnished in separate containers (see 3.1.1) ~~shall be packaged as follows:~~

5.1.1.1. Zinc oxide-vehicle. The zinc oxide-vehicle will be packaged in a can with a 1 gallon capacity conforming to PPP-C-96, type V, class 2, with exterior coating plan B or in a pail with a 5 gallon capacity conforming to PPP-P-704, type III, class 3 or 4 as specified (see 6.2).

5.1.1.2. Zinc dust powder. The zinc dust powder shall be packaged in a can with a 1 gallon capacity conforming to PPP-C-96, type V, class 2 with exterior coating plan B or in a pail with a 5 gallon capacity conforming to PPP-P-704, type II, class 3 or 4 as specified (see 6.2).

5.1.1.3. Kits. The zinc oxide-vehicle and the zinc dust powder in 1 gallon cans ~~as specified in 5.1.1.1 and 5.1.1.2~~ shall be packaged in a close-fitting box conforming to PPP-B-636, class weather-resistant. A fiberboard partition shall be provided between the cans with the fiberboard meeting the requirements of PPP-F-320, type CF, class domestic, variety SW, grade 200. The box shall be closed in accordance with the appendix to PPP-B-636.

5.1.2 Level B. The primer ingredients and kits shall be packaged as specified ~~in 5.1.1~~ <sup>above</sup> except the exterior coating for the cans and pails shall be a commercial coating and the fiberboard box shall be class domestic.

5.1.3 Level C. The primer ingredients and kits shall be packaged to afford protection against damage during shipment from the supplier to the initial destination.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. Unless otherwise specified ~~(see 6.2)~~ the primer kits of the same type shall be packed in a close-fitting box conforming to PPP-B-601, overseas type; PPP-B-621, class 2; PPP-B-636, class weather-resistant; or PPP-B-640, class 2. The box shall be closed and strapped in accordance with the appendix to the applicable box specification. No packing required for the 5 gallon pails.

5.2.2 Level B. Two primer kits of the same type packaged ~~as specified in 5.2.1~~ shall be packed in a close-fitting box conforming to PPP-B-636, class domestic. The box shall be closed in accordance with method I of the appendix to PPP-B-636. No packing required for the 5 gallon pails.

5.2.3 Level C. The primer ~~ingredients and kits~~ shall be packed to insure carrier acceptance and safe delivery at destination. Containers shall comply with Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable.

5.3 Marking.

5.3.1 Civil agencies. The interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 Military agencies. The interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

### 5.3.3 Special marking and labeling.

5.3.3.1 Cans and pails. Unless otherwise specified (See 6.2), each can and pail, shall be suitably marked or labeled. The markings shall be of a permanent nature, and the labels shall be securely attached so as not to come off the containers. The information shall be shown on the front side of the containers, and shall be as indicated in 5.3.3.2 for the zinc oxide-vehicle container and as indicated in 5.3.3.3 for the zinc dust container.

5.3.3.2 Zinc oxide-vehicle container. Primer, zinc dust oxide (contains zinc oxide-vehicle which shall be added to zinc dust), TT-P-641G type, lot number, stock number, date of manufacture, quantity of primer resulting after mixing with zinc dust from separate container, information as may be required by Federal and State laws, and manufacturer's name and address.

5.3.3.3 Zinc dust container. Zinc dust (to which the zinc oxide-vehicle is to be added) TT-P-641G, type, lot number, stock number, quantity of zinc dust in pounds, and manufacturer's name and address.

5.3.3.4 Directions for use. The directions for use, which shall be clearly legible, shall be shown on the reverse side of the zinc oxide-vehicle container ~~as follows~~.

#### DIRECTIONS FOR USE OF FEDERAL SPECIFICATION TT-P-641G, PRIMER COATINGS: ZINC DUST-ZINC OXIDE (FOR GALVANIZED SURFACES)

"This zinc dust-zinc oxide coating is intended for use as a priming coat on new or old galvanized metal. It is also satisfactory as a finish coat and may be used in one or more coats. One coat hides completely and is adequate for many service conditions on new galvanized iron. Two coats are ample for rusty galvanized surfaces, except under acid or other exposure conditions that normally require special finish coats to protect a reactive type primer. Types I and II primer are recommended for ordinary atmospheric exposure. Type III primer is preferred where severe moisture conditions prevail or where the metal is to be exposed under water. Chemical treatment by phosphoric acid-based or other cleaners before priming with type III primer. Dirt and greasy material shall be removed by cleaning with a solvent, such as turpentine or mineral spirits, before pretreating or painting. This is a semiprepared primer with the zinc oxide mill-ground in the entire vehicle in one container and the zinc dust in a separate container. For mixing, the zinc dust should have a small portion of the zinc oxide-vehicle added to it and mixed to a homogeneous state. The proportions of zinc dust and of zinc oxide-vehicle required for preparing one gallon of ready-to-use primer are approximately as follows:

	Type I	Type II	Type III
Zinc dust, pounds	14.54	7.94	8.50
Zinc oxide-vehicle, pounds	8.76	8.06	8.10

One gallon of mixed primer may be readily prepared by weighing the indicated amount of zinc dust into a gallon-can and then adding the zinc oxide-vehicle until the can is full. The primer may be applied by brushing or spraying. For spraying of types I and II primer, add 1 pint of mineral spirits, TT-T-291, type II, to each gallon of primer. For spraying of type III primer, add 1 pint of thinner TT-T-306, to each gallon of primer. The spreading rate should be approximately 600 square feet per gallon."

"Caution. Keep primer away from flames. Provide adequate ventilation while applying the primer. Avoid prolonged inhalation of vapors. NOT INTENDED FOR USE ON THE INSIDE OF DRINKING WATER TANKS."

### 6. NOTES

6.1 Intended use. The intended use is described in the "Directions for Use", specified in 5.3.3.4.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Type of primer coating required (see 1.2.1).
- (c) Inspection responsibility, if other than as specified herein; and administrative provisions for inspection records, when applicable (see 4.1).
- (d) Size of container required (see 5.1.1.1 and 5.1.1.2).
- (e) Selection of applicable level of packaging and packing, and any special marking required (see 5.1, 5.2, and 5.3). When packing is different than specified (see 5.2.1).

6.3 Type I primer is an orthodox linseed oil coating for air drying (not baking). Types II and III cover primer with a synthetic resin vehicle--air-drying or baking--which dry faster than type I primer. Type II primer contains a long oil linseed-modified phthalic alkyd resin vehicle as typified by TT-R-266, type II. Type III primer contains 25-gallon oil length paraphenyl phenolformaldehyde resin vehicle. Types II and III coatings may be baked at temperature up to 200°F.

6.4 No chemical treatment of the galvanized metal is contemplated prior to using types I and II primers for ordinary outdoor exposure, but standard accepted treatments may be used if it seems desirable. For severe moisture conditions or where the metal is to be exposed under water, it is recommended that the galvanized metal be given a chemical treatment before applying type III primer. Phosphoric acid solutions of the zinc phosphate and phosphate-chromate types sold under proprietary brands are among the most satisfactory for this purpose. Dirt and greasy material should be removed by cleaning with a solvent, such as turpentine or mineral spirits, before pretreating or painting.

6.5 While the primary function of zinc dust-zinc oxide primer is to provide adequate adherence to galvanized metal, it is also satisfactory as a finish coat and may be used in one or more coats. One coat hides completely and is adequate for many service conditions on new galvanized iron. Two coats are ample for rusty galvanized surfaces, except under acid or other exposure conditions that normally require special finish coats to protect a reactive-type primer. The primer retains its gray color very well on prolonged exposure to the weather. For finish coats, but not for priming new or only slightly weathered galvanized iron, the primer may be tinted (see 3.2). For example, chrome oxide green gives a soft, pleasing green, which is very durable and shows good color retention.

6.6 Zinc dust-zinc oxide primer should be purchased by volume, the unit being one gallon (equal to 3.785 liters) at 15°C (60°F). Volume is to be determined on the basis of the mixed product. The manufacturer shall furnish the correct proportion of zinc oxide-vehicle in sufficient amount to yield a volume, when mixed, equal to that stated in the purchase order.

6.7 One gallon of zinc dust-zinc oxide primer meeting this specification will have the following characteristics, when the minimum figures are met, and the pigment is a mixture of 80 percent zinc dust and 20 percent zinc oxide:

Composition by volume

	Type I	Type II	Type III
	Gallon	Gallon	Gallon
Zinc dust.....	0.2474	0.1350	0.1445
Zinc oxide.....	.0779	.0425	.0455
Total pigment.....	0.3253	0.1775	0.1900
Nonvolatile vehicle.....	.5887	.2940	.3544
Total Solids.....	0.9140	0.4715	0.5444
Volatile (thinner and drier)....	.0860	.5285	.4556
Total primer (gallon).....	1.0000	1.0000	1.0000

## Composition by weight

	Type I	Type II	Type III
	Pounds	Pounds	Pounds
Zinc dust.....	14.54	7.94	8.50
Zinc oxide.....	3.63	1.98	2.12
Pigment total.....	18.17	9.92	10.62
Nonvolatile vehicle.....	4.57	2.61	2.99
Total solids.....	22.74	12.53	13.61
Volatile (thinner and drier)...	.56	3.47	2.99
Total primer, weight per gallon	23.30	16.00	16.60

Civil Agency Interest

GSA-FSS  
 COM-NBS  
 DOT-FIS  
 NASA-JFK  
 GSA-PCD  
 INT-BPA

Preparing activity:

GSA-FSS

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KSC-SPEC-1-1  
January 20, 1969

JOHN F. KENNEDY SPACE CENTER, NASA

SPECIFICATION, QUALIFICATION,  
PRODUCTS, CORROSION CONTROL

This specification has been approved by the Design Engineering Directorate of the John F. Kennedy Space Center (KSC) and is mandatory for use by KSC and associated contractors.

1. SCOPE

1.1 Scope. - This document establishes the qualification tests, service requirements, and procedure by which a product has been listed or shall be approved for listing on the KSC Corrosion Control Products List, CCPL-0001.

1.2 Classification. - Coating materials shall be self-curing and of the following types and classes:

- Type I Class I - Inorganic Zinc - Organic solvent reducible
- Type I Class II - Inorganic Zinc - Water reducible
- Type II Class I - Organic Zinc - Single component
- Type II Class II - Organic Zinc - Two or more components

2. ~~APPLICABLE DOCUMENTS~~

2.1 The following documents, of the issue in effect on the date of invitation for bids, form a part of this specification to the extent specified herein.

Specifications

Federal

TT-P-460 - Pigment, Zinc - Dust (Metallic-Zinc - Powder) Dry

Standards

FED-STD-141a - Paint, Varnish Lacquer and Related Materials;  
Methods of Inspection, Sampling and Testing.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

### 3. REQUIREMENTS

3.1 Qualification.-- A product must be tested in accordance with the requirements of this specification and must pass all the qualification tests specified herein, to be listed on or approved for listing on CCPL-0001.

3.2 Materials.-- The coating materials shall be composed of the following vehicles and pigments, formulated and manufactured to produce a uniform, high quality product capable of meeting all the requirements of this specification.

3.2.1 Type I Class I.-- Type I Class I coating material shall be composed of the following:

3.2.1.1 Vehicle.-- The vehicle shall be a solution of suitable diluent and an organic derivative of silica that shall hydrolyze in the presence of atmospheric moisture to a dried film of inorganic silicate.

3.2.1.2 Pigment.-- The pigment shall be principally zinc dust, and shall contain no organic material. Limited amounts of suitable inorganic reinforcements may be added as deemed necessary by the manufacturer. The zinc dust shall conform to the requirements of TT-P-460.

3.2.1.3 Composition.-- The nonvolatile portion of the vehicle shall contain less than 10% by weight organic material when tested in accordance with 4.3.1.5.

3.2.1.4 Heat Resistance.-- The coating shall show no evidence of carbonization when exposed to a temperature of 750°F for 24 hours.

3.2.2 Type I Class II.-- Type I Class II coating material shall be composed of the following:

3.2.2.1 Vehicle.-- The vehicle shall be an aqueous solution of a quaternary - ammonium silicate, alkali metal silicate, or other suitable alkali metal complexes.

3.2.2.2 Pigment.-- The pigment shall be principally zinc dust, and shall contain no organic material. Limited amounts of suitable inorganic reinforcements may be added as deemed necessary by the manufacturer. The zinc dust shall conform to the requirements of TT-P-460.

3.2.2.3 Composition.-- The nonvolatile portion of the vehicle shall contain less than 10% by weight organic material when tested in accordance with 4.3.1.5.

3.2.2.4 Heat Resistance.-- The coating shall show no evidence of carbonization when exposed to a temperature of 750°F for 24 hours.



3.2.3 Type II Class I.- Type II Class I coating material shall be packaged in a single container and shall be composed of the following:

3.2.3.1 Liquid Vehicle.- The vehicle shall be a solution of suitable diluent and non-saponifiable organic and/or inorganic binder.

3.2.3.2 Pigment.- The pigment shall be principally zinc dust. Limited amounts of suitable reinforcements may be added as deemed necessary by the manufacturer. The zinc dust shall conform to the requirements of TT-P-460.

3.2.4 Type II Class II.- Type II Class II coating material shall be two or more components, packaged in separate containers, composed of the following:

3.2.4.1 Liquid Vehicle.- The vehicle shall be a solution of suitable diluent and non-saponifiable organic and/or inorganic binder.

3.2.4.2 Pigment.- The pigment shall be principally zinc dust. Limited amounts of suitable reinforcements may be added as deemed necessary by the manufacturer. The zinc dust shall conform to the requirements of TT-P-460.

3.3 Color.- Coating material furnished under this specification shall be grey in color. No tint shall be added that will appreciably effect change in color from that of the characteristic metallic color of the zinc pigment.

3.4 Description.- A dry film thickness of 4.0 to 6.0 mils shall be attainable with one coat, which may consist of multiple passes. Where coatings are composed of components to be mixed at the time of application, the minimum proportion for any component shall be at least five percent by volume of the total.

3.5 Toxicity.- The coating shall be readily applied to a surface with no appreciable toxicological effect on personnel and shall produce no more than a mild dermatitis if contact is made with the skin during mixing of the coating components.

3.6 Coating Characteristics.- Data for material characteristics shall be provided by individual suppliers as listed in Table I. The data shall be established for each coating material prior to request for service test. The purpose of this data is to determine that the product being supplied is that which was approved under qualification testing.

TABLE I - CHARACTERISTICS

1. Chemical nature
2. Number of components
3. Percent by volume of total pigmentation
4. Percent by volume of non-volatile vehicle
5. Percent by volume of metallic zinc
6. Percent by volume of volatile
7. Weight in pounds per gallon mixed ready for application
8. Viscosity
9. Flash point
10. Pot life
11. Drying or curing time
12. Mixing instructions
13. Application instructions

3.7 Pot Life.-- The pot life of the coating, mixed and ready for application, shall be a minimum of six hours when tested in accordance with 4.3.1.4.

3.8 Drying or Curing Time.-- Coating shall be rain resistant as follows:

- Type I Class I - 30 minutes
- Type I Class II - 2 hours
- Type II Class I - 2 hours
- Type II Class II - 2 hours

3.9 Flash Point.-- Coating shall not flash at temperatures lower than 65°F except that Type I Class II shall have no flash point when tested in accordance with 4.3.1.3.

3.10 Weight per Gallon.-- Coating shall meet the following minimum weight requirements per gallon when mixed, and ready for application:

- Type I Class I - 16 pounds
- Type I Class II - 21 pounds
- Type II Class I - 13 pounds
- Type II Class II - 13 pounds

3.11 Salt Spray Resistance.-- When tested in accordance with 4.3.1.6 the coating shall show no blistering, wrinkling, or loss of adhesion. There shall be no general surface deterioration, pitting, or other visual evidence of panel corrosion.

3.12 Inhibitive Properties.-- When tested in accordance with 4.3.1.7, the coating shall inhibit the spread of corrosion beyond a maximum of 1/32 inch on either side of the score line (a total width of 1/16 inch).

3.13 Service.-- The coating shall show less than 5 percent film failure when tested in accordance with 4.3.1.8.

3.14 Service Use.-- The coating shall continue to provide excellent protection against corrosion without excessive touch-up for a minimum of three years.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection.-- Unless otherwise specified, the supplier is responsible for the performance of all inspection requirements as specified in 4.3.1.1. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

#### 4.3 Test Procedures.

4.3.1 Testing under this specification shall be for the purpose of:

- (a) Qualification
- (b) Quality conformance inspection

4.3.1.1 Qualification Tests.-- Qualification tests shall consist of all tests specified in this specification. All tests other than those for compliance with requirements of 3.13 and 3.14 shall be made by the supplier. After completion of these tests, the supplier shall submit the results of the tests on NASA Form No. , showing compliance with 3.6 through 3.12 for the mixed coating with a request for the service test specified in 3.13. The supplier shall also submit an infrared analysis of the non-volatile portion of the liquid component and an elemental analysis (emission spectroscopy) of the dry component for Type I Class I and Type I Class II coatings.

A minimum of twenty gallons of material and necessary thinners, to be furnished by the supplier, will be required for the service test. The service test will be conducted at Kennedy Space Center, Florida.

4.3.1.1.1 Qualification Approval.-- To be granted qualification approval the material must pass the 18 months service test specified in 3.13.

4.3.1.1.2 Qualification Retention.-- Qualification retention will be based on comparative performance with other materials on CCPL-0001 of the same Type and Class. At any time after the 18 months service test the records indicate a material has failed or performance is not equal to other materials on the CCPL, the product will be removed from the CCPL and the supplier will be notified.

4.3.1.2 Quality Conformance Inspection.-- Quality conformance inspection by the government shall consist of all tests required for coating characteristics in 3.6.

4.3.1.3 The following tests shall be conducted in accordance with FED-STD-141a:

<u>Test</u>	<u>Method</u>
Percent by volume of total pigmentation.	4312
Percent by volume of non-volatile vehicle.	4312
Percent by volume of metallic zinc.	7221 Note 1
Percent by volume of volatile.	4312
Weight in pounds per gallon mixed ready for application.	4184
Viscosity	4281
Flash point	4294

Note 1: 7.14 grams per milliliter shall be used as specific gravity of zinc.

4.3.1.4 Pot Life.— Two or more component materials shall be mixed, in accordance with the suppliers instructions, in a suitable container so as to result in one gallon of finished material. Mixed material shall remain in a closed container, ambient conditions above 70°F and 50 percent relative humidity, for 6 hours. Material shall then be tested and must meet all requirements of this specification for application and performance.

4.3.1.5 Organic Content.— The decanted liquid, extracted from the mixed coating in accordance with Method 4312 (extraction mixture B shall be used for Type I Class I products) of Federal Test Method Standard No. 141a, shall be tested for organic content as follows:

- a. Weigh to the nearest 0.1 mg. several grams of the material from a stoppered flask into a porcelain evaporating dish which has been previously ignited and weighed.
- b. Heat the dish and its contents in a properly ventilated convection type oven at  $225^{\circ} \pm 50^{\circ}\text{F}$  for 3 hours. Cool the dish and its contents in a desiccator to room temperature and weigh to the nearest 0.1 mg.

- c. Transfer the weighed dish and its contents to a muffle furnace and heat at 900° to 1000°F for one hour. Cool in a desiccator, weigh and calculate the percentage of carbonaceous matter.

#### 4.3.1.6 Salt Spray Resistance.

##### 4.3.1.6.1 Test Panels.

- a. Material - Test panels shall be prepared from hot rolled mild sheet steel plates. Any convenient size and thickness may be used except that panels shall be at least 4 inches wide, 6 inches long, and 1/8 inch thick.
- b. Surface Preparation - Panels shall be washed in solvent and dried. The entire panel shall be blasted using any suitable equipment and blasting material. The panels shall be blast cleaned to white metal.
- c. Application - Coating application shall be accomplished within 1 hour after blast cleaning is completed. Dry film thickness shall be 4-6 mils on all surfaces. Coating shall be mixed, thinned, and applied in accordance with manufacturer's instructions and the requirements of this specification. Panel shall be in a nearly vertical position during application and for at least 5 minutes after completion of application.

4.3.1.6.2 Salt Spray.- Panels shall be exposed in accordance with Method 6061 of Federal Test Method Standard No. 141a except that they shall not be scored. Exposure time shall be:

Type I Class I - 4000 Hours  
Type I Class II - 4000 Hours  
Type II Class I - 1500 Hours  
Type II Class II - 1500 Hours

(Test panels and color photographs of panels before and after exposure shall be submitted with request for service test.)

4.3.1.7 Inhibitive Properties.- Panels shall be prepared, cleaned, coated, and exposed as specified in 4.3.1.6.1 except they shall be scored and the time of exposure shall be 30 days.

4.3.1.8 Service Test.- A coating material having met all the requirements of this specification shall be service tested by the Government under field conditions for a minimum period of 18 months. Application shall be in accordance with the supplier's instructions and to all extent possible to his satisfaction.

5. PREPARATION FOR DELIVERY

5.1 Packaging.-- Unless otherwise specified, packaging shall be in accordance with the manufacturer's commercial practice, except containers shall be limited to 1 gallon size.

6. NOTES

6.1 With respect to product qualification under this specification, awards will be made only for such products that have been tested and approved for inclusion in Corrosion Control Products List CCPL-0001. Manufacturers are urged to arrange to have the products they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The Support Operations Directorate, National Aeronautics and Space Administration, John F. Kennedy Space Center, Florida 32899 will administer all activities required for maintaining the Corrosion Control Products List, CCPL-0001 in conformance with this specification and information pertaining to qualification of products may be obtained from that agency.

6.2 This specification is the result of a continuing test program at Kennedy Space Center. Its purpose is to provide the Government with the lowest cost per square foot corrosion protection for carbon steel exposed to a marine atmospheric environment. Performance records will be maintained and this data will be used for future revisions of this specification and may require reevaluation of products granted qualification under existing requirements.

6.3 Retention of products now listed on CCPL-0001 will be contingent on the following:

1. That the manufacturer furnish the Support Operations Directorate, National Aeronautics and Space Administration, John F. Kennedy Space Center, Florida, 32899, with all data required under this specification.
2. That the values of the data furnished meets or exceeds the requirements of this specification and is received within 12 months of the published date of this specification.

Notice.-- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

FD-350C-1-0002  
January 20, 1969

Custodian:

NASA-John F. Kennedy Space Center

Preparing Activity: .

John F. Kennedy Space Center  
Civil Engineering and Facilities Branch  
Design Engineering Directorate

4 OCT 1961

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29 May 1961  
SUPERSEDING  
MIL-P-15145A  
20 June 1955

MILITARY SPECIFICATION  
ENAMEL, ZINC DUST PIGMENTED, FRESH WATER TANK  
PROTECTIVE, FORMULA NO. 102

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 This specification covers a corrosion-inhibiting coating for interior of fresh water (potable) tanks.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

- RR-S-366 - Sieves, Standard for Testing Purposes.
- TT-D-643 - Drier, Paint, Naphthenate, Liquid, Concentrated.
- TT-P-143 - Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing, and Marking of.
- TT-P-460 - Pigment, Zinc-Dust (Metallic-Zinc-Powder), Dry.
- TT-T-291 - Thinner; Paint, Volatile Mineral Spirits (Petroleum-Spirits).
- TT-Z-301 - Zinc-Oxide; Dry, and Paste-in-Oil.

MILITARY

- MIL-A-15206 - Aluminum Stearate.
- MIL-V-15218 - Varnish (Mixing, Phenolic).
- MIL-L-19868 - Labels for Hazardous Industrial Chemicals and Materials.

STANDARDS

FEDERAL

- FED-STD-141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling, and Testing.

(Copies of specifications, standards, drawings, and publications required by contractors in

connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. - The following document, forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

OFFICIAL CLASSIFICATION COMMITTEE  
Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York 16, N. Y.)

3. REQUIREMENTS

3.1 Zinc dust pigmented enamel shall consist of ingredients conforming to the applicable specifications in the proportions shown in table I.

TABLE I. Formula No. 102

Ingredients	Pounds 1/
Aluminum stearate (Spec. MIL-A-15206)	23
Zinc oxide (Spec. TT-Z-301) (American process)	234
Alkyl-phenolic mixing varnish, Type II of Specification MIL-V-15218	229
Paint thinner (grade 1, of Spec. TT-T-291)	300
Cobalt naphthenate drier (type II of Spec. TT-D-643)	2.3
Manganese naphthenate drier (type III of Spec. TT-D-643)	2.3
Zinc dust (type II of Spec. TT-P-460)	934

1/ The formula is given to approximate 100 gallons.

3.1.1 The zinc dust shall not be processed with the remaining ingredients. The material as supplied shall consist of two portions, one portion consisting of all ingredients except the zinc dust, designated hereinafter as the zinc oxide base enamel, the other portion consisting of the zinc dust.

[Esc 1010]



3.1.2 The formula shown in table I is designated Navy Standard Formula No. 102. Wherever Formula No. 102 is specified, the enamel shall conform to this specification.

3.2 Requirements applicable to zinc oxide base enamel.

3.2.1 Manufacture. - The component raw materials shall be mixed and ground as required to produce a product which is uniform, homogeneous, free from grit, entirely suitable for the purpose intended, and in full conformity to the requirements of this specification.

3.2.2 Requirements of base enamel. - The requirements which are in table II shall be the criteria, by laboratory tests as specified in paragraph 4.3, that the enamel has been manufactured in accordance with the formula and good practice.

Table II - Requirements of base enamel.

Characteristic	Requirements	
	Minimum	Maximum
Pigment, percent by weight of enamel	30.0	34.0
Volatile, percent by weight of enamel	47.0	50.5
Nonvolatile vehicle, percent by weight of enamel (calculated by difference)	17.0	20.5
Water, percent by weight of enamel	----	0.5
Coarse particles and skins (as residue retained on standard No. 325 sieve (Spec. RR-S-366)), percent by weight of enamel	----	0.5
Viscosity, Krebs units	57	67
Weight per gallon, pounds	9.2	9.6
Fineness of grind	4	----
Flash point, degrees F.	100	----
Compatibility with thinner	to pass test	
Flexibility	to pass test	
Odor	to be normal	
Resin and resin derivatives	to be absent	
Phenolic resin	to be present	

3.2.2.1 Pigment. - The pigment extracted from the zinc oxide base enamel and ignited shall show a minimum of 98 percent by weight of zinc oxide when analyzed by the method specified in 4.3.2.1.

3.2.2.2 Condition in container. - The product shall be capable of being readily broken up with a paddle to a smooth, uniform consistency and shall not liver, exceed 60 Krebs units in viscosity, exceed 6 hours dry hard time, curdle, gel nor show any

other objectionable properties for at least one year after date of manufacture.

3.3 Requirements applicable to completed enamel (obtained by mixing zinc oxide base enamel and zinc dust). - The completed zinc dust pigmented enamel shall conform to table III, when subjected to the applicable tests specified in section 4.

TABLE III. Characteristics of completed enamel

	Minimum	Maximum
Set-to-touch, hours . . . . .	-----	0.5
Dry hard, hours . . . . .	-----	4.0
Settling . . . . .	Topass test	
Water resistance . . . . .	Topass test	

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality assurance shall be provided in accordance with method 1031 of Standard FED-STD-141.

4.2.1 Ingredient materials. - A one pint sample from each lot of the specified phenolic resin and when requested by proper authority, a one pint sample from each lot of the other ingredient materials shall be taken by the Government representative for test purposes.

4.3 Test procedures. -

4.3.1 Ingredient materials. - The phenolic resin shall be tested to determine compliance with the applicable specification. Other ingredient materials submitted shall be tested to determine compliance with the applicable specifications.

4.3.2 Tests applicable to zinc oxide base enamel. -

4.3.2.1 The following tests shall be conducted in accordance with the methods specified in Standard FED-STD-141:

Test	Method
Pigment (using extraction mixture "C")	4021
Volatiles	4041
Nonvolatile vehicle (calculated by difference)	4053
Water	4081
Coarse particle and skins	4091
Viscosity	4281
Weight per gallon	4184
Fineness of grind	4411
Odor	4401
Rosin and rosin derivatives	5031
Phenolic resins	5141
Flashpoint	4291
Zinc oxide	7091

#### 4.3.2.2 Flexibility. -

4.3.2.2.1 Panel. - The panel shall be cut from bright tin plate weighing not more than 25 grams (gm.) nor less than 19 gm. per square decimeter (0.51 to 0.39 pound per square foot). (Commercial No. 31 gage (0.0105 inch thick) bright tin plate weighs approximately 0.44 pound per square foot.) The panel shall be 3 inches wide, and shall be free of sharp bends or dents. The edges of the panel shall be lightly sanded to remove burrs due to cutting.

4.3.2.2.2 Film applicator. - The applicator shall be of such construction and dimensions that the thickness of the resulting dried film of the enamel under test is 0.0014-0.0003 inch. (An applicator which has been successfully used is shown on figure 1.) The applicator shall be made of suitable nonmagnetic material.

4.3.2.2.3 Magnetic chuck. - The magnetic chuck shall be of the permanent magnet type. The area of the working surface on the chuck shall be greater than the area of the panel and the chuck shall have sufficient magnetic strength to hold the tin panel in contact with the chuck throughout the area of the panel.

4.3.2.2.4 Procedure. - The handle of the magnetic chuck shall be adjusted to the "off" position. A sheet of paper (newspaper will be suitable) shall be laid on the chuck. The tin panel shall be placed on the paper and the handle adjusted to the "on" position. The panel shall now be cleaned with benzol or other suitable solvent. A small quantity of enamel shall be placed on one end of the panel and a film spread by means of the applicator specified in 4.3.2.2.2. The handle shall be adjusted to the

"off" position, the panel removed and allowed to air-dry 2 hours in a horizontal position and then baked 24 hours in an air circulating oven at 100° to 105° centigrade (C.). At the end of the baking period the panel shall be allowed to stand for 30 minutes at 25° ± 5°C. and then bent at its midpoint through 180 degrees over a 1/8-inch mandrel. The painted surface of the panel shall be uppermost during the bending which shall be accomplished at a uniform rate over a period of approximately two seconds. The panel shall be examined at the bend using a 5-power lens and any cracking shall be noted.

4.3.2.3 Compatibility with thinner. - Compatibility with thinner shall be determined by method 4203 of Standard FED-STD-141. The base enamel as received shall be mixed with thinner in the ratio of one volume of enamel to one volume of thinner conforming to grade 1 of Specification TT-T-291. Observation shall be made immediately after mixing and also 30 minutes after mixing.

4.3.3 Tests applicable to completed enamel (zinc oxide base enamel to which zinc dust has been added).

4.3.3.1 Preparation of enamel for test. - To 150 gm. of zinc oxide base enamel, add 934 gm. of zinc dust, in increments of 50 to 100 gm. and mix until free of lumps and no dry particles of zinc dust are noted when a drawdown film of the mixture is applied on glass. Add 641 gm. of zinc oxide base enamel in increments of 50 to 100 gm. and mix thoroughly. (Thorough mixing is necessary to eliminate all absorbed and entrapped air.)

4.3.3.2 Settling. - Fill a 1-pint glass jar with enamel prepared as specified in 4.3.3.1, cover with a cap containing a tiny vent, and set aside for observation at the end of 48 hours. No evidence of hard setting or caking shall be noted, and the enamel shall be easily stirred with a flexible spatula to a smooth, uniform consistency.

4.3.3.3 Time of setting to touch and drying. - The time of setting to touch and drying shall be determined by method 4061 of Standard FED-STD-141 except that a film whose thickness (wet) is 0.003 inch, as applied by a drawdown blade, shall be used (blade clearance of 0.006 inch will usually give this thickness).

#### 4.3.3.4 Water resistance. -

4.3.3.4.1 Pickling panels. - The water resistance of the enamel shall be determined on 6 by 12 inch, 0.0478 ± 0.005 inch (18 gage), black iron panels, prepared in duplicate. The panels shall be pickled in 5 percent by volume H<sub>2</sub>SO<sub>4</sub> (specific gravity 1.84) at 150° Fahrenheit (F.) to remove all mill scale, thoroughly rinsed with tap water and

allowed to dry. The panels shall be wire brushed to a bright rust-free surface immediately before application of enamel.

4.3.3.4.2 Application of enamel. - Two coats of enamel prepared as specified in 4.3.3.1, shall be applied. Sufficient enamel to give a dry film thickness of  $0.0015 \pm 0.0002$  inch shall be applied to each side of each panel for each coat. Coating technique shall be so controlled that the panel edges are completely sealed. Twenty-four hours drying time shall be allowed between first and second coats. The following procedure is recommended for applying the enamel: Weigh 5 gm. of enamel onto panel. Using a tared (or weighed) 1-inch brush, previously saturated with enamel, spread the enamel in an even film. Reweigh brush which should not gain or lose more than .25 gm.

4.3.3.4.3 Test procedure. - Twenty-four hours after applying the second coat the panels shall be suspended on a glass rod and submerged 10 inches in water at  $150^\circ \pm 5^\circ\text{F.}$ , for 18 hours and then removed for 6 hours. The cycle shall be repeated 2 more times. The fourth and final cycle shall be 18 hours in water, one hour out of water and 3 hours in boiling water. The panel shall be removed from water, allowed to recover 1 hour and then examined. No evidence of rusting, pimpling, blistering, cracking, checking, nor loss of adhesion shall be noted on the immersed portion of the panel. (The formation of fine pimples at the water line shall be disregarded.)

## 5. PREPARATION FOR DELIVERY

5.1 Packaging. - Packaging shall be Level A or C as specified (see 6.2). The base enamel shall be furnished in 1-quart cans or 5-gallon pails as specified (see 6.2). The zinc dust shall be furnished in cans containing 2.8 pounds or pails containing 55.5 pounds as specified (see 6.2).

5.1.1 Level A. - The base enamel and zinc dust shall be packaged in cans and pails as specified in Specification TT-P-143 for liquid pigmented products. Pails for zinc dust shall be of volume adequate to contain the quantity specified.

5.1.2 Level C. - The base enamel and zinc dust shall be packaged in containers normally used in accordance with the contractor's commercial practice.

5.2 Packing. - Packing shall be Level A, B or C, as specified (see 6.2).

### 5.2.1 Level A. -

5.2.1.1 Cans. - An equal number of cans of zinc dust and base enamel not to exceed 12 each

shall be packed in boxes as specified in Specification TT-P-143.

5.2.1.2 Pails. - One pail of zinc dust and one pail of base enamel shall be packed in wood or wood-created boxes as specified in Specification TT-P-143.

### 5.2.2 Level B. -

5.2.2.1 Cans. - An equal number of cans of zinc dust and base enamel not to exceed 12 each shall be packed in boxes as specified in Specification TT-P-143.

5.2.2.2 Pails. - One pail of zinc dust and one pail of base enamel shall be packed in wood or wood-created boxes as specified in Specification TT-P-143.

5.2.3 Level C. - The material shall be packed in containers in a manner which will insure acceptance by common carrier and safe delivery at destination. Shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations or regulations of other carriers as applicable to the mode of transportation.

5.3 Marking. - In addition to any special marking (see 6.2) required by the contract or order, marking for shipment shall be in accordance with Specification TT-P-143.

### 5.3.1 Labeling. -

5.3.1.1 Each container of base enamel shall have affixed a warning label of appropriate size similar to class 1 of Specification MIL-L-19863 ~~as shown in the photograph attached with reasonable dimensions.~~ Under "contains" shall be inserted "petroleum thinners of  $100^\circ\text{F.}$  minimum flash point". For unit containers that also serve as shipping containers any conflict with ICC Regulations shall be resolved by reasonable modification of size of label or use of warning statement without label design.

5.3.1.2 A label or tag with the following instructions shall be attached to each 5-gallon can of base enamel:

Mixing Instructions: To 1 gallon of contents add all of the accompanying zinc dust in increments of  $2\frac{1}{2}$  to 5 pounds and mix with paddle until free from lumps and no dry particles of zinc dust are noted when a draw-down coat of the paste is applied by means of a spatula on glass. Add remaining 4 gallons of enamel in increments of  $1\frac{1}{2}$  gallon, mixing after each addition until homogeneous.

Warning: Do not mix zinc dust with enamel until just prior to use. Mix only enough for the job to be done. DO NOT STORE MIXED ENAMEL.

5.3.1.3 A label or tag with the following instructions shall be attached to each 1-quart can of base enamel:

Mixing instructions: To 1 quart of contents add all of the accompanying 2.8 pounds of zinc dust and mix with paddle until free from lumps and no dry particles of zinc dust are noted when a drawdown coat of the paste is applied by means of a spatula on glass. Mix until homogenous.

Warning: Do not mix zinc dust with enamel until just prior to use. Mix only enough for the job to be done. DO NOT STORE MIXED ENAMEL.

## 6. NOTES

6.1 Intended use. - Zinc dust pigmented enamel is intended for use as a corrosion inhibiting coating for interior of fresh water (potable) tanks.

6.2 Ordering data. - Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Whether zinc dust is required in 55.5-pound steel pails or 2.8-pound steel cans (see 5.1).
- (c) Whether base enamel is required in 5-gallon pails or 1-quart cans (see 5.1).

Custodians:  
Army - CE  
Navy - Ships  
Air Force - MOA

(d) Level of packaging and level of packing required (see 5.2).

(e) Special marking required (see 5.3).

6.3 For information only, the following composition by volume is included:

Composition by volume	Gallons per 100 gallons
Aluminum stearate . . . . .	2.76
Zinc oxide . . . . .	5.03
Alkyl-phenolic mixing varnish . . . . .	29.79
Paint thinner . . . . .	45.96
Cobalt naphthenate drier . . . . .	.29
Manganese naphthenate drier . . . . .	.29
Zinc dust . . . . .	15.88

6.4 Zinc oxide base enamel should be purchased by volume, the unit being a U.S. gallon at 15.5°C. (60°F.). Zinc dust should be purchased by weight the unit being 55.5 pounds (1 gallon).

6.5 Zinc oxide base enamel supplied in 5-gallon pails should be mixed with 55.5 pounds of zinc dust and when supplied in 1-quart cans should be mixed with 2.8 pounds of zinc dust.

Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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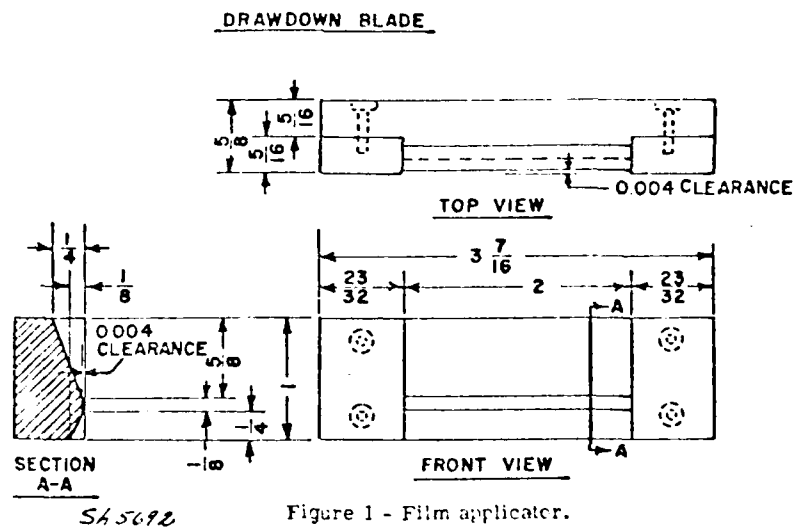


Figure 1 - Film applicator.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-H004
<p style="text-align: center; margin: 0;"><u>INSTRUCTIONS</u></p> <p style="margin: 0;">This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).</p>		
SPECIFICATION		
ORGANIZATION (of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? <div style="margin-top: 10px;">             A. GIVE PARAGRAPH NUMBER AND WORDING.           </div>		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <div style="margin-top: 10px;"> <input type="checkbox"/> YES      <input type="checkbox"/> NO IF "YES", IN WHAT WAY?           </div>		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

DD FORM 1426  
1 APR 63

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

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MIL-P-26915A(USAF)  
Amendment-1  
28 March 1972

4 OCT 1972  
MILITARY SPECIFICATION

PRIMER COATING, ZINC DUST PIGMENTED, FOR STEEL SURFACES

This amendment forms a part of Military Specification  
MIL-P-26915A(USAF) dated 18 Nov 1960.

Page 1. Add new paragraph:

1.1.2 Non-photochemically reactive primer coating. This amendment contains requirements for a material employing non-photochemically reactive solvents for use in areas under air pollution regulations.

Page 1, paragraph 2.1, federal specifications:

Delete "QQ-S-636 Steel; Carbon (Low Carbon), Sheets and Strips," and substitute "QQ-S-698 Steel, Sheet and Strip, Low Carbon."

Add: "TT-E-489 Enamel, Alkyd Gloss (For Exterior and Interior Surfaces)."

Add: "TT-L-32 Lacquer, Cellulose Nitrate, Gloss, For Aircraft Use."

Add: "TT-S-735, Standard Test Fluids, Hydrocarbons."

Delete: "Toluol (For Use In Organic Coatings)" and substitute "Toluene, Technical."

Delete: "Tape, Masking; Paper (Pressure Sensitive)" and substitute "Tape, Pressure-sensitive, Adhesive, Masking Paper."

Add: "PPP-D-704, Pails, Metal: (Shipping, Steel, 1 through 12 Gallons)."

Add: "PPP-D-705, Drum, Metal Shipping, Steel, (Over 12 and Under 55 Gallons)."

FSC 8010



MIL-P-26915A(USAF)  
Amendment-1

Delete: "PPP-D-760, Drums and Pails, Metal (5 and 16.64 Gallon)".

Page 2 paragraph 2.1, military specifications:

Delete: "JAN-H-792, Humidity Cabinet: Operation of"

Delete: "MIL-H-3136, Standard Test Fluids Hydrocarbons and Iso-Octane."

Delete: "MIL-L-7178, Lacquer, Cellulose Nitrate, Gloss, For Aircraft Use."

Delete: "MIL-E-7729, Enamel, Gloss, For Aircraft Applications."

Page 2. Add new paragraph:

"2.2. Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM D 1748

Rust Protection by Metal Preservatives  
In the Humidity Cabinet.

ASTM D 2267

Method of Test for Acromatics in Light  
Naphthas, Reformates, and Gasolines by  
Gas Chromatography.

(Application for copies should be addressed to the American Society  
for Testing and Materials, 1915 Race St., Philadelphia, Pennsylvania  
19103.)

Page 3, Add new paragraph:

3.2.3.2 Volatile Content. The volatile content of the admixed and thinned coating shall consist of a non-photochemically reactive solvent blend. A non-photochemically reactive solvent is any solvent with an aggregate of less than 20 percent of its total volume composed of the chemical compounds classified below or which does not exceed any of the following individual percentage composition limitations, referred to the total volume of solvent:

(a) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers or ketons having an olefinic or cycloolefinic type of unsaturation: 5 percent;

(b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent

(c) A combination of ethylbenzene, ketones having branched hydro-carbon structures, trichloroethylene or toluene: 20 percent

Page 4, paragraph 3.4.6. Delete and substitute: "3.4.6. Miscibility with thinner. When tested in accordance with 4.6.1, the primer shall be compatible with mineral spirits conforming to Specification TT-T-291 in ratios up to one part of thinner to one part of primer or with toluene conforming to Specification TT-T-548 in ratios up to one part of thinner to four parts of primer."

Page 5, paragraph 3.5.6.2. Delete "MIL-H-3136, type III" and substitute "TT-S-735, type III."

Page 6, paragraph 3.5.11. Delete "MIL-L-7178" and "MIL-E-7729" and substitute "TT-L-32" and "TT-E-489" respectively.

Page 7, paragraph 4.4.1: Delete "QQ-S-636" and substitute "QQ-S698."

Page 9, paragraph 4.4.3.2: Delete "MIL-E-7729" and "MIL-L-7178" and substitute "TT-E-489" and "TT-L-32" respectively.

Page 10. Add new paragraph:

4.6.2.1. Non-photochemically reactive solvent. The non-photochemically reactive solvent content with reference to the total volume of the solvent as specified in 3.2.3.2 shall be tested in accordance with ASTM D 2267.

MIL-P-26915A(USAF)  
Amendment-1

Page 11, paragraph 4.6.10, b: Delete "MIL-L-7178 and substitute  
"TT-L-32."

Page 12, paragraph 4.6.10, e: Delete "MIL-E-7729 and substitute  
"TT-E-489."

Page 12, paragraph 4.6.12: Delete "MIL-H-3136" and substitute  
"TT-S-735."

Page 13, paragraph 4.6.14: Delete "Specification JAN-A-792" and  
substitute "ASTM-D 1748."

Page 15, paragraph 5.1.1.1: Delete "or PPP-D-760" and substitute  
"PPP-D-704 or PPP-D-705."

CUSTODIAN:  
AIR FORCE-84

PREPARING ACTIVITY:  
AIR FORCE - 84

Project No.  
8010-F020

☆ U. S. GOVERNMENT PRINTING OFFICE: 1972 - 714-165/6565

18 November 1960

Superseding

MIL-P-26915(USAF)

12 June 1956

## MILITARY SPECIFICATION

## PRIMER COATING, ZINC DUST PIGMENTED, FOR STEEL SURFACES

## 1. SCOPE

1.1 Scope.- This specification covers zinc dust primer for use on steel surfaces.

1.2 Classification.- The zinc dust primer shall be of the following types and classes, as specified (see 6.2):

Type I - Air-dry cure

Type II - Bake cure

Class A - Ready-mixed, single-package material

Class B - Ready-to-mix, two-component material

## 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

## SPECIFICATIONS

## Federal

QQ-S-636	Steel; Carbon (Low-Carbon), Sheets and Strips
TT-P-143	Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing, and Marking of
TT-P-460	Pigment, Zinc-Dust (Metallic-Zinc-Powder), Dry
TT-T-291	Thinner, Paint, Volatile Mineral Spirits (Petroleum Spirits)
TT-T-548	Toluol (For Use In Organic Coatings)
UU-T-106	Tape, Masking; Paper (Pressure-Sensitive)
PPP-C-96	Cans, Metal, 28 Gage and lighter
PPP-D-729	Drums, Metal, 55-Gallon (For Shipment of Noncorrosive Materials)

FSC 8010

MIL-P-26915A (USAF)

## SPECIFICATIONS

### Federal (Cont'd)

PPP-D-760

Drums and Pails, Metal (5 and 16.64 Gallon)

### Military

JAN-H-792

MIL-H-3136

Humidity Cabinet; Operation of Standard Test Fluids Hydrocarbons and Iso-Octane

MIL-L-7178

Lacquer, Cellulose Nitrate, Gloss, For Aircraft Use

MIL-E-7729

MIL-L-7808

Enamel, Gloss, For Aircraft Application  
Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

MIL-I-19537

Lacquer; Acrylic-Nitrocellulose, Gloss (For Aircraft Use)

MIL-I-19538

Lacquer; Acrylic-Nitrocellulose, Camouflage (For Aircraft Use)

MIL-C-27227

Coating, Polyurethane, Thermal Resistant, For Aircraft Application

## STANDARDS

### Federal

Fed. Test Method  
Std. No. 141

Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing

Fed. Std. No. 595

Colors

### Military

MIL-STN-129

Marking For Shipment and Storage

(Copies of documents required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. REQUIREMENTS

3.1 Components.- The type I and type II, class A, primers shall be ready-mixed, single package materials. The type I and type II, class B, primers shall be ready-to-mix, two-component materials, the components being furnished in separate component containers. (The dry

zinc dust shall be in one container and the liquid vehicle in the other container.) For the class B, ready-to-mix primers, the container size, where specified, shall refer to the liquid vehicle container which shall hold enough of the vehicle to provide the specified volume of the mixed primer. For example, a 1-gallon container shall be of the standard 1-gallon size and shall contain an adequate amount of liquid vehicle to provide at least 231 cubic inches of the mixed primer.

3.2 Materials.- The manufacturer is given wide latitude in the selection of raw materials and processes of manufacture but shall be restricted by the requirements of this specification. The materials used shall be of high quality and entirely suitable for the purpose intended.

3.2.1 Hazardous compounds.- At the time of submission of bid, the manufacturer shall certify that the primer contains no materials that should require toxicological precautions other than those normally practiced in conventional painting.

3.2.2 Zinc dust pigment.- The zinc dust pigment shall conform to the requirements of Specification TT-P-460, type II.

3.2.3 Liquid vehicle.- The liquid vehicle portion of the primer shall be suitable for the intended purpose and, when mixed with the required amount of zinc dust, shall provide a coating that will conform to the requirements of this specification. It shall contain no resin nor resin derivatives when tested as specified in 4.6.1.

3.2.3.1 Nonvolatile content.- The nonvolatile content of the liquid vehicle shall be not less than 32 percent by weight.

3.3 Quantitative requirements.- The primer (class A ready-mixed and class B after mixing) shall meet the quantitative requirements specified in table I.

Table I. Quantitative Requirements of Primer

Characteristic	Requirements	
	Minimum	Maximum
Total solids, percent by weight of primer	72	
Zinc content, percent of total solids		
Type I, classes A and B	80	
Type II, classes A and B	70	
Water content, percent by weight of primer		0.25
Flash point, of	80	
weight per gallon	16.3	

### 3.4 Qualitative requirements

3.4.1 Mixing.- When tested as specified in 4.6.4, the type I and type II, class A and B, primers shall be easily mixed by hand to form a smooth homogeneous material free from lumps or other objectionable characteristics.

3.4.2 Odor.- The odor of the wet primer and the dry film shall not be obnoxious when tested as specified in 4.6.1.

3.4.3 Coarse particles and skins.- When tested in accordance with 4.6.1, the percentage of coarse particles and skins retained on the sieve shall not exceed by more than 0.5 percent the total amount of residue retained when the dry zinc pigment is subjected to the sieve test.

3.4.4 Primer stability.- When tested after standing undisturbed for 5 days as specified in 4.6.5, the class B primer shall not have settled to the extent that it cannot be easily redispersed into a smooth homogeneous mixture by handmixing.

3.4.5 Effects of aging.- When tested in accordance with 4.6.6, the aged class B primer shall be at least equal to the unaged material.

3.4.6 Miscibility with thinner.- When tested in accordance with 4.6.1, the primer shall be compatible with mineral spirits conforming to Specification TT-T-291 or with toluene conforming to Specification TT-T-548 in ratios up to one part of thinner to one part of primer by volume.

3.4.7 Skinning.- When tested in accordance with 4.6.1, the primer shall not skin when allowed to stand undisturbed for 48 hours.

3.4.8 Storage stability.- At the time of submission of bid, the manufacturer shall certify that after 1 years storage at a temperature of  $90^{\circ}\text{F} \pm 10^{\circ}\text{F}$ , the primer shall be capable of meeting all of the requirements of this specification.

### 3.5 Film properties

3.5.1 Application.- The primer shall be suitable for application by spraying over solvent-cleaned, phosphoric-acid-treated, or sand-blasted steel. In one cross-coat, applied by spray, at least 2.0 mils in dry film thickness shall be deposited. One hour after application, the coating shall be smooth and even and free of runs, sags, streaks, or other imperfections. The primer for spraying shall be thinned in accordance with the manufacturer's recommendations.

### 3.5.2 Drying time

3.5.2.1 Type I.- A film of the primer, prepared and tested in accordance with 4.6.8, shall dry dust free in not more than 10 minutes and shall dry through in not more than 1 hour.

3.5.2.2 Type II.- A film of the primer, prepared and tested in accordance with 4.6.8, shall dry dust free in not more than 20 minutes and shall be fully cured after being air-dried for 20 minutes and baked for a maximum of 1 hour at 250° F. The baked coating shall be free from checking, wrinkling, or other imperfections.

3.5.3 Flexibility.- A film of the primer shall show no cracking nor loss of adhesion in the bend area when tested as specified in 4.6.9.

3.5.4 Lifting properties.- When tested in accordance with 4.6.10, topcoating films applied to the primer shall produce no lifting nor other film imperfections.

3.5.5 Adhesion.- Coatings of the primer, the primer plus lacquer, and the primer plus enamel shall show no lifting, flaking, nor other signs of damage when tested as specified in 4.6.11.

### 3.5.6 Fluid resistance properties

3.5.6.1 Water resistance.- Immediately upon removal from 48-hour immersion in distilled water at 75° F for primer film and 24-hour immersion for primer topcoated with enamel or lacquer, the primer and topcoat films shall show no wrinkling, blistering, loss of adhesion, nor other visible defects. (Slight softening shall be disregarded.) Twenty-four hours after removal, the immersed portion of the films shall be equal in hardness and color to the unimmersed portion. (See 4.6.12.)

3.5.6.2 Hydrocarbon resistance.- When tested as specified in 4.6.12, a film of the primer or the primer plus topcoats shall show no wrinkling, blistering, loss of adhesion, nor other visible defects immediately after removal from 24 hours immersion at 75° F in fluid conforming to Specification MIL-E-3136, type III. (Slight softening shall be disregarded.) Twenty-four hours after removal, the immersed portion of the films shall be equal in hardness and color to the unimmersed portion.

3.5.6.3 Synthetic fluid resistance.- A film of the primer, prepared and tested in accordance with 4.6.12, shall show no wrinkling, blistering, loss of adhesion, nor other defects immediately after removal from 168 hours immersion at 160° F in fluid conforming to Specification MIL-I-7808. (Slight softening or staining shall be disregarded.)



### 3.5.7 weathering properties

3.5.7.1 Accelerated weathering.- The primer shall not be adversely affected by 300 hours accelerated weathering when tested as specified in 4.6.13.

3.5.7.2 Weather exposure.- At the time of submission of bid, the manufacturer shall certify that a single coat of the primer,  $2.5 \pm 0.5$  mils in dry film thickness, shall provide adequate protection for steel and show no appreciable deterioration when exposed in the vicinity of Miami, Florida for 1 year in full outdoor sunlight at an angle of 45 degrees from the vertical facing south.

3.5.8 Humidity resistance.- when tested in accordance with 4.6.14, a coating of the primer and the primer plus topcoat shall show no blistering, wrinkling, nor loss of adhesion.

3.5.9 Salt spray resistance.- when tested in accordance with 4.6.15, a coating of the primer and the primer plus topcoat shall show no blistering, wrinkling, nor loss of adhesion. There shall be no rusting nor other visual evidence of panel corrosion.

3.5.10. Inhibitive properties.- when tested in accordance with 4.6.16, a primer-coated panel shall inhibit the spread of corrosion beyond a maximum of 1/8 inch from the score line.

3.5.11 Topcoating properties.- The primer shall provide a suitable base for topcoating with additional coats of primer, with lacquer conforming to Specification MIL-L-7178, and with enamel conforming to Specification MIL-E-7729 when tested as specified in 4.6.17.

3.5.12 Heat resistance.- The primer shall not be adversely affected by a 24-hour bake at 350° F when tested as specified in 4.6.18.

3.5.13 Electrical resistance (type I primers only).- The electrical resistance shall not exceed 10 ohms per inch thickness when tested in accordance with 4.6.19.

3.5.14 Color.- The color of the primer shall be characteristic of the zinc pigment and shall approximate color No. 36231 of Federal Standard No. 595.

3.6 Workmanship.- The ingredient materials shall be intimately assembled and processed as required in accordance with the best practice for the manufacture of a high-quality primer.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests.- The inspection and testing of the zinc dust primer shall be classified as acceptance tests.

4.3 Sampling.- Sampling, inspection, and testing shall be conducted in accordance with the provisions of Federal Test Method Standard No. 141, method 1031, and as specified herein.

#### 4.4 Test panels

4.4.1 Test panel material.- Test panels shall be prepared from sheet steel conforming to Specification A-S-636, cold-rolled, and may be of any convenient size and thickness subject to the following limitations:

- a. Unless otherwise specified, panels shall be at least 2 inches wide by 4 inches long.
- b. Panels for the flexibility tests shall be  $22 \pm 2$  mils thick.
- c. Other test panels shall be not less than 30 nor more than 60 mils thick.

#### 4.4.2 Surface preparation of test panels

4.4.2.1 Solvent-cleaned panels.- Test panels shall be selected from smooth steel free from rust. The panels shall be scoured with steel wool, washed in solvent (acetone, methyl ethyl ketone, toluene, or trichloroethylene) and then rinsed in clean solvent. After the panels have air-dried, they shall be wiped clean with a solvent-dampened, clean, lint-free cloth.

4.4.2.2 Phosphoric-acid-cleaned panels.- The test panels selected shall be free from other than light rusting. They shall be scoured with steel wool to remove rust or other adhering contamination,

washed in solvent as in 4.4.2.1, rinsed in clean solvent, and air-dried. The panels shall then be treated as follows:

a. Immerse for 2 hours in an acid cleaner of the following composition maintained at a temperature of  $75^{\circ} \pm 2^{\circ}$  F:

3150 ml of water  
650 ml of technical grade, 85 percent phosphoric acid  
3.8 grams of diethyl 1, 3, thiourea  
1.4 grams of alkyl aryl sulfonate wetting agent.

b. Rinse in water and immerse for 15 minutes in the following dichromate solution maintained at a temperature of  $75^{\circ} \pm 2^{\circ}$  F:

3785 ml of water  
114 grams of potassium dichromate

c. Force dry the panels at a temperature of  $190^{\circ}$  to  $212^{\circ}$  F.

4.4.2.3 Sand-blasted panels.- The panels shall be washed in solvent as specified in 4.4.2.1, rinsed in clean solvent, and dried. The entire panel shall be blasted using any suitable equipment and blasting material. The blasting material shall be free from oil, grease, dirt, water, or other materials that would impair the coatability of the panel surface. After blasting, the panels shall be cleaned by using clean compressed air or a vacuum.

#### 4.4.3 Coating of test panels

4.4.3.1 Application of primer.- After preparation specified in 4.4.2, the panels shall be kept clean and free from fingerprints, rust, etc. Application of at least 1 coat of primer shall be accomplished within a maximum of 1 hour after cleaning, or the cleaned panels may be stored in clean toluene for not more than 72 hours prior to coating. The primer shall be thoroughly mixed and thinned in accordance with the manufacturer's instructions. Unless otherwise specified a single coat of the primer shall be applied by spray, using a wet cross coat, to a dry film thickness of  $2.5 \pm 0.5$  mils. The panel shall be in a nearly vertical position during spraying and for at least 2 minutes after completion of spraying. Panels that are to be used for salt spray, humidity, or other tests where corrosion or rusting of the panel is a factor shall be coated on both sides and, in addition, shall be dipcoated around the edges to a distance of approximately  $1/8$  inch. The coating shall be air-dried or baked, as applicable. Panels to be tested with the primer only shall be aged for at least 10 days prior to testing.

4.4.3.2 Application of topcoats.- After the primed panels have air-dried for not less than 1 hour nor more than 24 hours or bake cured, whichever is applicable, the specified topcoating shall be applied by spray. Primer topcoating shall be applied to a dry film thickness of  $2.5 \pm 0.5$  mils. Other topcoating materials shall be applied to a dry film thickness of  $1 \pm 0.25$  mils and air-dried for at least 5 days prior to testing. Except where otherwise indicated in the specific test method, enamel and lacquer used for topcoating purposes shall conform to Specifications MIL-E-7729 and MIL-L-7178 respectively.

4.5 Test conditions.- Unless otherwise specified, all testing, conditioning, curing, etc., shall be conducted under standard laboratory conditions of  $75^\circ \pm 2^\circ$  F and  $50 \pm 5$  percent relative humidity.

#### 4.6 Test methods

4.6.1 The tests of this specification shall be conducted in accordance with the applicable methods of Federal Test Method Standard No. 141, as listed in table II, and other methods as described in 4.6.2 through 4.6.19.2.

Table II. Test Methods

Test	Fed. Std. No. 141 Method No.
Nonvolatile (solids) content	1/4041 or 4042
Resin	2/5031
Water content	4081
Flash point	4291
Odor	4401
Coarse particles and skins	4091
Miscibility	4203
Skinning	4141
Weight per gallon	4184
Color	2/4250

- 1/ For class A (ready-mixed) primers, the nonvolatile content of the liquid vehicle shall be determined on the vehicle isolated in accordance with 4.6.3.1.
- 2/ For class A (ready-mixed) primers, the rosin test shall be conducted on the vehicle isolated in accordance with the requirements of 4.6.3.1.
- 3/ Deviation from color No. 36231 of Federal Standard No. 595 shall not be cause for rejection provided the color is characteristic of the zinc pigment and an approximate match to the specified shade.

4.6.2 Zinc dust pigment.- The dry zinc dust pigment shall be tested according to the requirements of Specification TT-P-460.

#### 4.6.3 Zinc content

4.6.3.1 Class A (ready-mixed) primers.- The vehicle portion of the primer shall be isolated in accordance with method 4032 of Federal Test Method Standard No. 141. The total zinc as Zn in the remaining solids shall be determined in accordance with the procedure described in method 7221 of the same standard.

4.6.3.2 Class B (unmixed) primers.- The percentage of zinc dust in the dry film shall be determined as follows: Using one unopened unit of primer (one container of liquid vehicle and the companion container of dry zinc dust) accurately determine the total weight of each component by comparing the weight of the full containers to that of identical, empty, clean containers. Determine the nonvolatile content of the liquid vehicle according to the method listed in table II. Calculate the percent of zinc dust in the dry film as follows:

$$\frac{A \times 100}{A + \frac{(B \times C)}{100}} = D$$

A = Weight of zinc dust  
 B = Percentage of nonvolatile in the vehicle  
 C = Weight of vehicle  
 D = Percentage of zinc in the dry film.

#### 4.6.4 Mixing

4.6.4.1 Types I and II, class A.- A 1-quart sample of the primer shall be briskly stirred by hand for not more than 5 minutes. After the primer appears homogeneous or at the end of the 5-minute period, whichever occurs first, the primer shall be allowed to stand for 1 minute. It shall then be poured slowly into another container. The primer shall be observed during pouring and the residue remaining in the mixing container observed for compliance with 3.4.1.

4.6.4.2 Types I and II, class B.- A 1-quart sample of the primer shall be mixed according to the manufacturer's instructions. The material shall be briskly stirred, by hand, during the mixing. The complete mixing shall be accomplished in not more than 5 minutes. After the mixture appears homogeneous or at the end of the 5-minute period, whichever occurs first, the material shall be allowed to stand for 1 minute. It shall then be poured slowly into another container. The primer shall be observed during pouring and the residue remaining in

the mixing container observed for any evidence of lumps or pigment that has not been wetted by the liquid vehicle.

4.6.5 Primer stability (class B only).- A 1-quart container shall be filled to within approximately 1/2 inch from the top with well-mixed primer. The container shall be sealed and stored at  $75^{\circ} \pm 2^{\circ}$  F undisturbed for 5 days. At the end of this period, the container shall be opened and the primer hand-mixed for not more than 3 minutes. There shall be no evidence of undispersed lumps of pigment remaining after completion of the stirring. (Small amounts of pigment clinging to the stirrer shall not be cause for rejection.)

4.6.6 Effects of aging.- Using the class B primer aged in accordance with 4.6.5, panels shall be prepared and tested in accordance with 4.6.8, 4.6.11, 4.6.14, and 4.6.15. These panels shall be tested concurrently with similar panels prepared from unaged primer. The panels coated with the aged primer shall be at least equal in all properties tested to those coated with unaged primer.

4.6.7 Application.- Panels shall be prepared, cleaned, and coated in accordance with 4.4.1, 4.4.2, and 4.4.3.1, respectively. The coated panels shall be examined for conformance with 3.5.1.

4.6.8 Drying time.- The drying time of the primer shall be determined in accordance with method 4061 of Federal Test Method Standard No. 141 except that the primer shall be sprayed on a solvent-cleaned steel panel, as specified in 4.4, to a dry film thickness of  $2.5 \pm 0.5$  mils. The drying time shall be in accordance with 3.5.2.

4.6.9 Flexibility.- Solvent-cleaned panels coated with primer as specified in 4.4 and cured as applicable shall be bent 180 degrees over a 1/4-inch mandrel in accordance with method 6221 of Federal Test Method Standard No. 141. Similar panels shall be conditioned for 1 hour at  $-65^{\circ}$  F and while still at that temperature bent around a 4-inch diameter mandrel. The panels shall be visually examined immediately for evidence of failure, and then after conditioning to room temperature shall be re-examined to determine compliance with 3.5.3.

4.6.10 Lifting properties.- Solvent-cleaned panels coated with 1 spray coat of primer as specified in 4.4.3.1 and air-dried for not less than 1 hour nor more than 24 hours for type I primer and bake cured for type II primer shall be topcoated with the following materials (one material only per panel) in accordance with 4.4.3.2:

- a. The primer sample being tested
- b. Lacquer (Specification MIL-L-7178)
- c. Lacquer (Specification MIL-L-19537)

MIL-P-26915A (USAF)

- d. Lacquer (Specification MIL-L-19533)
- e. Enamel (Specification MIL-E-7719)
- f. Polyurethane coating (Specification MIL-C-27227).

The panels shall be examined for conformance to 3.5.4.

4.6.11 Adhesion.- Test panels cleaned by each of the three methods given in 4.4.2 shall be coated with the following combinations of coatings and cured as specified in 4.4.3: primer, primer plus lacquer, and primer plus enamel. Two parallel scratches down to metal, using a stylus, shall be made 1 inch apart. A 1-inch wide strip of masking tape conforming to Specification UU-T-106 shall be applied, adhesive side down, across the scratches. The tape shall be pressed down using two passes of a 4-1/2 pound rubber-covered roller approximately 3-1/2 inches in diameter by 1-3/4 inches in width, the surface of which has a Durometer hardness value within the range of 70 to 80. The roller shall be moved at the rate of approximately 1 inch per second. The tape shall be removed in one abrupt motion with the pull exerted at approximately a 90 degree angle to the panel, and the panel examined for damage, such as removal of topcoat from primer or the entire system from the metal. Stripping of the tape shall be done immediately after application thereof. Adhesion testing for the aged primer (4.6.6) shall be conducted on solvent-cleaned panels only.

4.6.12 Fluid resistance properties.- Solvent-cleaned panels prepared, coated, and cured as specified in 4.4 shall be half immersed in the specified fluids (see 3.5.6). Immersions in water and hydrocarbon fluid shall consist of panels coated with primer only, primer plus lacquer, and primer plus enamel. Synthetic-fluid immersion panels shall be coated with primer only. Immersion in distilled water shall be 48 hours at 75° F for the primer only and 24 hours at 75° F for the primer plus topcoats. Immersion in fluid conforming to Specification MIL-H-3136, type III, shall be 24 hours at 75° F; and immersion in synthetic fluid shall be 168 hours at 160° F. Resistance properties shall conform to the requirements of 3.5.6.

4.6.13 Accelerated weathering.- Steel panels, solvent-cleaned, coated, and cured as specified in 4.4 with primer, primer plus lacquer, and primer plus enamel shall be subjected to 300 hours exposure to accelerated weathering in accordance with method 6152 of Federal Test Method Standard No. 141. Following this exposure, the panels shall be inspected for loss of flexibility, blistering, loss of either intercoat or metal adhesion, or any other apparent defects. (Slight whitening of the film shall be disregarded.)

4.6.14 Humidity resistance.- Panels prepared by each of the three cleaning methods specified in 4.4.2 shall be coated with primer only, primer plus one coat of lacquer, and primer plus one coat of enamel,

and cured as specified in 4.4. The panels shall be exposed in a humidity cabinet conforming to Specification JAF-H-792 and operated at  $120^{\circ} \pm 2^{\circ} \text{F}$  and 100 percent humidity. The type I primer shall be exposed for 48 hours and the type II primer for 168 hours. After exposure the panels shall be examined for conformance to 3.5.8.

4.6.15 Salt spray.- Panels shall be prepared, cleaned, coated with primer only, primer plus lacquer, and primer plus enamel, and then cured as specified in 4.4. They shall then be exposed in accordance with method 6061 of Federal Test Method Standard No. 141 except that they shall not be scored. Panels with the type I primer shall be exposed for 144 hours and panels with type II primer for 336 hours.

4.6.16 Inhibitive properties.- Panels shall be prepared, cleaned, coated, cured and exposed as specified 4.6.15 except that they shall be scored and the time of exposure shall be 21 days. After the exposure period, the panels shall be removed, washed in water without scrubbing, allowed to dry, and examined for conformance to 3.5.10.

4.6.17 Topcoating properties.- Panels with primer applied shall be observed for suitability for topcoating during the preparation of panels for other tests. Panels topcoated with lacquer and enamel shall be observed for any tendency towards intercoat adhesion failure during evaluation of adhesion 4.6.11, humidity resistance, 4.6.14, and salt-spray resistance, 4.6.15. Any appreciable primer-topcoat separation shall be considered evidence of unsatisfactory topcoating properties.

4.6.18 Heat resistance.- Steel panels cleaned with solvent, coated with one coat of primer, and cured as specified in 4.4 shall be exposed in an oven to a temperature of  $350^{\circ} \pm 5^{\circ} \text{F}$  for 24 hours. The panels shall then be removed and conditioned to room temperature. The coating shall be tested for adverse effects by the flexibility test, 4.6.9, and the humidity test, 4.6.14. Performance of the oven-exposed coating shall be equal to or better than the unexposed coating.

#### 4.6.19 Electrical resistance

4.6.19.1 Preparation of test panels.- Five test panels shall be prepared as follows: Sheets of aluminum foil 2 inches by 2 inches and not more than 0.0015 inch thick shall be cut from smooth material. The sheets shall be rinsed in clean solvent and air-dried. Two foil sheets shall then be cemented on a glass sheet 2 inches wide, not less than  $4 \frac{1}{4}$  inches long, and not less than  $\frac{1}{8}$  inch thick. The foil sheets shall be positioned so that the sheets are directly opposite each other and so that the adjacent edges of the two sheets are parallel and  $\frac{1}{4}$  inch apart at any given point. The length of each sheet along the adjacent edges shall be 2 inches. The adhesive used to attach the foil



to the glass shall be of a nonconductive type and shall not be softened by, nor bleed into the primer. The adhesive shall be applied so that the dry film thickness, for 1/2 inch back from each of the adjacent foil edges, shall not exceed 0.0003 inch. The total thickness of the aluminum foil plus the adhesive shall not exceed 0.0018 inch at any point within 1/2 inch of the adjacent edges of the foil. The area of the foil sheets within 1/2 inch of the adjacent edges shall be smooth and uniformly adhered to the glass. After the adhesive has dried, the adjacent edges of the foil sheets shall be lightly sanded to remove any adhesive. Any adhesive adhering to the glass in the area between the foil sheets shall be either removed or sanded smooth; care shall be exercised to avoid any damage to the adjacent edges of the foil sheets. At least three measurements of the thickness of the assembled panel shall be taken along each of the adjacent foil edges; a screw-type micrometer with a ratchet-tightening attachment shall be used. The panels shall then be cleaned with a clean, solvent-dampened rag and allowed to air-dry. (See 6.3.)

4.6.19.2 Test procedure.- The test procedure for determining the electrical resistance of the primer shall be as follows: Cover approximately a 1/2-inch wide strip of the foil along each end of the panel with masking tape. Spray-coat the foil side of the panel with freshly mixed primer, using a cross-coat technique. Apply sufficient coats to give a dry-film coating thickness of 0.008 to 0.010 inch and allow 15 minutes air-dry between each cross coat. Allow the panel to air-dry for 5 days. Accurately determine the coating thickness by repeating the three measurements along each of the adjacent edges of the aluminum foil and average the six results. Strip the masking tape from the ends to expose the bare aluminum foil. Using any suitable accurate ohmmeter firmly place the two leads on the bare foil, one lead on each end of the panel, and record the resistance reading. Calculate the ohms per inch reading by multiplying the ohms resistance by the average coating thickness in inches. Repeat the procedure for each of the other four panels. Average the resistance of all five panels. Discard any individual resistance that varies from the average by more than 2 ohms per inch and average the remaining results provided at least three panels remain. If less than three remain, repeat the entire test. (See 6.3.)

## 5. PREPARATION FOR DELIVERY

5.1 Pack-aging. Packaging shall be level A or C as specified (see 6.2).

~~Class~~ Level A

~~Class~~ Class A primer.- Class A ready-mixed primer shall be packaged in accordance with Specification TT-P-143 in quantities as

specified by the procuring agency. Containers shall conform to Specification PPP-C-96, PPP-D-729, or PPP-D-760.

~~5.2.1.4~~ Class B primer.- Class B ready-to-mix primer shall be packaged according to the requirements of Specification TT-P-143. The dry zinc dust and the liquid vehicle shall be packaged in separate containers. Quantities in each of the containers shall be such that the entire contents of one container shall be mixed with the entire contents of the companion container to provide the correctly proportioned mixed primer. (For liquid vehicle containers larger than 5 gallons the appropriate amount of zinc dust may be packaged in two or more containers.) In addition, the companion containers of dry zinc dust and liquid vehicle, for units up to and including 1-gallon size, shall be packed together in the same package. One container of liquid vehicle and the companion container of dry zinc dust shall be considered as one unit of primer.

~~5.2.2~~ Level C.- Packaging shall be in accordance with the manufacturer's commercial practice.

5.2 ~~Packing~~.- Packing shall be level A, B, or C as specified (see 6.2).

~~5.2.1~~ Level A.- The primer shall be packed in overseas type shipping containers according to the requirements of Specification TT-P-143.

~~5.2.2~~ Level B.- The primer shall be packed in domestic type shipping containers according to the requirements of Specification TT-P-143.

5.2.3 Level C.- The primer shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Rules or regulations of other carriers applicable to the mode of transportation.

5.3 Marking.- Interior and exterior containers shall be marked in accordance with the requirements of Standard MIL-STD-129. In addition, individual containers shall be marked, either by stencil or durably attached labels, with mixing, thinning, application, and curing instructions, as applicable. Each dry zinc dust container shall bear the following information:

Pigment, Zinc Dust  
Specification MIL-P-26915A(USAF) Type\*\_\_\_\_\_, Class\*\_\_\_\_\_  
Mix entire contents of this container  
with\* (amount)\_\_\_\_\_ of formula No.\*\_\_\_\_\_  
liquid vehicle.

~~Manufacturer shall enter appropriate data.~~

5.3.1 Precautionary marking.- Each container of ready-mixed, class A, primer and each container of liquid vehicle (class B primer) shall be marked with the following precautionary marking:

DO NOT STORE AT TEMPERATURES ABOVE 100° F.

## 6. NOTES

6.1 Intended use.- The primer specified herein is for use on steel surfaces intended for ground support equipment. For use under severe exposure such as on steel that is normally subjected to outside exposure, condensing moisture, or corrosive atmospheres, two coats of primer should be used. If color or finish texture is important, a coat of enamel or lacquer may be substituted for the second coat of primer. For less severe exposure, such as steel which is normally sheltered and not subjected to moisture or corrosive atmospheres, a single coat of the primer may be adequate. Type I primer is intended to provide galvanic protection. Type II is not intended to provide appreciable galvanic protection.

6.2 Ordering data.- Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class.
- c. That the unit of purchase and sale be the U. S. gallon of 231 cubic inches of mixed primer at 77° F.
- d. Selection of applicable levels of packaging and packing.
- e. Required type and size of container.

6.3 Electrical resistance.- The test for electrical resistance (4.6.19) consists essentially of applying the coating over two aluminum foil sheets and across a separating insulating space so that the coating must conduct any current across this space. It is important that the area of this space be accurately controlled and that the primer coating contact be continuous and uniform from one sheet of foil to the other. To guard against imperfections in the primer coating, the edges of the foil along the insulating space should be smooth, adhere firmly to the glass, and the "drop-off" from foil to glass held to a minimum. It is also very important that the zinc dust pigment be completely dispersed. Any loss of pigment such as settling prior to application will increase the electrical resistance of the applied coating.

NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the

fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

WWRCEE-2  
RLS/EC/hrd

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-1004
<p style="text-align: center;"><u>INSTRUCTIONS</u></p> <p>This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).</p>		
SPECIFICATION		
ORGANIZATION (of submitter)	CITY AND STATE	
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? <div style="margin-left: 20px;">             A. GIVE PARAGRAPH NUMBER AND WORDING.           </div>		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

DD FORM 1426  
1 APR 65

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

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4 OCT 1960 P.M.

## MIL-P-26915A PRIMER COATING, ZINC DUST PREPARED FOR STEEL SURFACES, November 18, 1960.

Amendment 1, March 28, 1972.

Type I Air dry cure; Type II Bake cure. To be provided as Class A - Ready-mixed, single package or Class B - Ready-to-mix, two component. Wide latitude choice of materials and manufacturing processes. ZINC DUST - Type II, 11-P-400, LIQUID VEHICLE - Nonvolatile not under 32%, Flash point not under 80°F, Water not over 0.25% by wt. primer, Rosin none, MINERAL PRIMER - Hazardous compounds to be absent; Total solids contain not under 72% zinc dust for Type I, not under 80% for Type II not under 70%; Particles retained 325 sieve not over 0.5%, lbs./gal. not under 16.3; Compatible with equal vol. mineral spirits (11-I-291) or toluene (11-I-540); Skinning none after 48 hrs. air exposure; Application to be satisfactory on solvent-cleaned, phosphoric-acid treated and sand-blasted steel; Dry dust free not over 10 minutes for Type I, not over 20 minutes for Type II; Dry through not over 1 hr. for Type I; Fully cured after 20 minutes air dry and one hr. bake at 225°F for Type II; Cracking and adhesion loss none when bent over 1 in. mandrel, none when bent over 4 in. mandrel after 1 hr. at -65°F; Tinting none under second coat of primer or of lacquer (MIL-L-7176) or of enamel (MIL-E-7729); Water resistance no wrinkling, blistering, or adhesion loss after 48 hrs. immersion for primer alone, after 24 hrs. for primer topcoated with enamel or lacquer; Hydrocarbon resistance no wrinkling, blistering or adhesion loss of topcoated primer after 24 hrs. immersion in Type III, MIL-H-3136; Synthetic fluid resistance no wrinkling, blistering or adhesion loss after 168 hrs. at 160°F in fluid MIL-L-7308; Accelerated weathering no adverse effects after 200 hrs. exposure; Weather resistance no appreciable deterioration of 2.0 mil film after one year Florida exposure; Humidity resistance no blistering, wrinkling or adhesion loss after 168 hrs. for Type II, 4 hrs. for 4 sec 1 exposure to 120°F and 100% humidity; Salt spray resistance no film failure or corrosion of steel panel after chamber exposure for 244 hrs. Type I, 336 hrs. Type II; Inhibitive properties no corrosion bet. and 1-8 inch of score line on primer coated steel panel after 21 days salt spray exposure; Heat resistance 24 hrs. at 350°F without adverse effects; Electrical resistance not over 10 ohms for a thickness of one inch, calculated from the length measured resistance of a film 4 in. long, 2 in. wide, and approx. 9 mil thick.

4 OCT 1956 P.M.

MIL-P-16450A(SHIPS)  
15 March 1957  
SUPERSEDED  
MIL-P-16450(SHIPS)  
5 April 1956  
MIL-P-16450(SHIPS)  
5 April 1956  
(See 6.6)

MILITARY SPECIFICATION  
PRIMER COATING, SHIPBOTTOM PAINT, ANTICORROSIVE

1. SCOPE

1.1 Scope. - This specification covers two classes of anticorrosive shipbottom paint for use on naval vessels as an undercoater for antifouling paints.

1.2 Classification. - The primer coating shall be of the following classes, as specified (see 3.2 and 6.2):

Class I - Formula 14N, medium brown.

Class II - Formula 14ND, dark brown.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

SS-R-406 - Road And Paving Materials; General Specifications, Methods Of Sampling And Testing.

TT-P-143 - Paint, Varnish, Lacquer, And Related Materials; Packaging, Packing And Marking Of.

TT-P-350 - Pigment, Lampblack-Dry.

TT-P-457 - Pigment, Venetian-Red, Dry.

TT-P-465 - Pigment, Zinc-Yellow (Zinc Chromate), Dry.

TT-T-775 - Tung Oil, Raw (China Wood) (For Use In Organic Coatings).

TT-T-801 - Turpentine, Gum Spirits, Steam Distilled Sulfate Wood, And Destructively Distilled.

TT-X-916 - Xylene (For Use In Organic Coatings).

MILITARY

MIL-M-15176 - Mica (Extender Pigment).

MIL-L-15180 - Linseed Oil, Alkali-Refined.

MIL-R-15184 - Resin, Para-Phenyl, Phenol-Formaldehyde.

MIL-S-15191 - Silica, Diatomaceous (Flatting-Extender Pigment).

MIL-L-17190 - Lead Linoleate.

STANDARDS

FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing.

MILITARY

MIL-STD-755 - Labels Containing Symbols For Packages And Containers For Hazardous Industrial Chemicals And Materials.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

FSC 7010



## 1. REQUIREMENTS

3.1 The manufacturer shall have facilities to manufacture paint in accordance with the processes specified in 3.3 and 3.4, particularly with respect to control of the weights of ingredient materials used and of the temperatures required in the processes. He shall have sufficient laboratory facilities to perform all of the tests required on the finished paint (see 6.2).

3.2 Formulas. - The formulas specified in Table I are designated Navy Formulas No. 14N and 14ND. Paints which are produced in conformance with the specification shall be manufactured in strict compliance with these formulas and processes, subject to adjustment for batch sizes and other requirements of this specification. Each ingredient shall conform strictly to its applicable specification or paragraph description. The amounts of xylene in the paint and the varnish ingredient may be adjusted to meet the viscosity requirements, provided the weight per gallon of the paint and of the varnish and the non-volatile requirements are also met.

Table I - Anticorrosive Shipbottom Paint Formulas

Ingredients	Specifications	Class I	Class II
		Pounds/100 Gallons	
Zinc Chromate	TT-P-465, Type II	297	297
Venetian Red	TT-P-457	50	50
Mica	MIL-M-15176, Type II	75	75
Diatomaceous Silica	MIL-S-15191	75	75
Varnish	See Table II	640	640
Lead Linolate (Solid)	MIL-L-17190	5	5
Xylene	TT-X-916, Grade B	20	20
Lampblack	TT-P-350		10

Table II - Varnish

Ingredients	Specifications	Pounds/100 Gallons
Phenolic Resin	MIL-R-15184	134
Cumarone-Indene Resin, Hard <sup>1/</sup>	Note (1)	134
Tung Oil	TT-T-775	64
Alkali Refined Linseed Oil	MIL-L-15180	42
Cumarone-Indene Resin, Soft <sup>2/</sup>	Note (1)	93
Xylene	TT-X-916, Grade B	243
Turpentine	TT-T-801	61

1/ Cumar V-3 manufactured by the Barrett Company and Neville R-12 manufactured by the Neville Company meet specification requirements.

2/ Cumar P-10 manufactured by the Barrett Company and Neville R-29 manufactured by the Neville Company meet specification requirements.

Note (1) - The cumarone-indene resins shall be derived chiefly from cumarone and indene and have the following properties:

## Requirements

	Hard resin	Soft resin
Appearance	Amber colored brittle solid	Amber colored viscous liquid
Color (Gardner)	15 maximum	15 maximum
Ash	0.1% maximum	0.2% maximum
Specific gravity (15°C./15°C.)	1.12 to 1.14	1.07 to 1.09
Flash point	220°C. minimum	150°C. minimum

# Requirements

	Hard resin	Soft resin
Softening Point	108 to 117°C.	5 to 10°C.
Iodine number	60 maximum	60 maximum
Solubility in acetone	Complete, clear solution	Complete, clear solution
Saponifiable matter	None	None
Acid number	1.0 maximum	1.0 maximum

Test shall be conducted with the applicable methods specified in FED-STD-141 as follows:

Test	Method
Ash	5261 5261
Flash point	4294 4294
Iodine number	5061 5061
Acid number	5072 5072
Specific gravity	4185 4185
Other test methods:	
Solubility in acetone	Complete as 50% resin solution, by weight. Clear solution.
Saponifiable matter	Reflux a 5 gram sample of resin with 50 ml. of 0.5N alcoholic KOH for one hour. Remove condenser and evaporate just to dryness. Extract residue with 25 ml. of boiling water and filter. (Water solution is a dark, reddish, clear solution.) Acidify with (1-1) H <sub>2</sub> SO <sub>4</sub> . (A precipitate forms and settles to bottom of container.) Any fatty material that floats on top of the solution indicates saponifiable matter.
Color	Prepare a solution of equal weights of the sample and toluol. Warm, if necessary, to complete solution. Determine the color of the solution as specified by Method 4248 of FED-STD-141.
Softening Point	Determine the softening point according to Method 216 (Softening Point of Bituminous Material (Ring and Ball Method)) of SS-R-406 with the following exceptions: <ul style="list-style-type: none"> <li>a. The bath liquid shall be ethylene glycol.</li> <li>b. The ring shall be a shouldered brass ring having the following dimensions: <ul style="list-style-type: none"> <li>Outside diameter (top) - 29/32 inch</li> <li>Outside diameter below shoulder - 3/4 inch</li> <li>Upper inside diameter - 25/32 inch</li> <li>Lower inside diameter - 5/8 inch</li> <li>Total depth (height of ring) - 1/4 inch</li> <li>Depth above shoulder - 7/64 inch</li> <li>Depth below shoulder - 5/64 inch</li> </ul> </li> <li>c. To insure uniform rapid distribution of the heat throughout the bath, the bath liquid (ethylene glycol) shall be stirred during the test. The temperature rise, after the first three minutes, shall be uniform at the rate of 5° ± 0.5°C. per minute.</li> </ul>

## 3.3 Varnish ingredient manufacturing procedure shall be as follows:

3.3.1 Heat the hard cumarone-indene resin, phenolic resin, tung oil, and linseed oil to 460 degrees Fahrenheit (°F.) in 45 to 50 minutes. Hold at 460°F. for 20 minutes. Pull from fire and add soft cumarone-indene resin and stir. Cool to 275°F. and thin.

## 3.4 Paint manufacturing procedure shall be as follows:

3.4.1 Mix lead linoleate to a thin paste with a small amount of the varnish ingredient (about 1 gallon). Add the thin paste to about one-half of the total varnish and then add pigments. Mix and grind on roller mill, or charge all ingredients into steel ball or pebble mill and rotate until required fineness of grind is obtained.

## 3.5 Quantitative requirements.

3.5.1 The paint shall conform to Table III as a further verification that the formulas in Table I have been followed.

Table III - Quantitative requirements

Characteristics	Minimum	Maximum
Pigment, percent by weight	42.5	44.0
Volatiles, percent by weight	--	24.0
Nonvolatile vehicle, percent by weight (calculated by difference)	32.0	--
Water, percent by weight	--	0.5
Coarse particles and skins, retained on No. 325 sieve, percent by weight	--	0.2
Viscosity, Krebs units	77	82
Weight per gallon, pounds	11.5	12.0
Fineness of grind	5	--
Time to dry to recoat, hours	--	3
Zinc oxide (ZnO), percent by weight of pigment	20.0	--
Chromium oxide (CrO <sub>3</sub> ), percent by weight of pigment	22.5	--

3.5.2 The varnish shall conform to requirement of Table IV.

Table IV

Viscosity	B-C (Gardner)
Nonvolatile	59-61 percent
Weight per gallon	Not less than 8.1 pounds
Appearance	Clear and homogeneous

3.6 Qualitative requirements.- The paint shall meet the following qualitative requirements:

3.6.1 Condition in container.- The paint shall be capable of being readily broken up with a paddle to a smooth, uniform consistency and shall not liver, thicken, curdle, gel, shall not exceed 100 Krebs units in viscosity, not show any other objectionable properties which would interfere with the proper application, for at least one year after date of manufacture.

3.6.2 Odor.- The odor shall be normal for the volatiles permitted.

3.6.3 Appearance of the dried film.- The paints, prepared as specified in 4.3.2.2, shall show no evidence of wrinkling or any other film defects.

3.6.4 Compatibility with thinner.- When one volume of the paint is diluted with one volume of thinner, there shall be no evidence of incompatibility (see 4.3.2.4).

3.6.5 Color.- The color shall be characteristic of the pigment used and shall be approximately the same as the standard color card (see 6.4).

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality assurance.- Quality assurance shall be provided in accordance with Method 1031 of FED-STD-141.

"4.2.1 Ingredient materials. When procured by Government activities in quantities of paint of 250 gallons or over, a one quart sample of each of the following: zinc chromate, varnish, phenolic resin, cumarone-indene resin hard, cumarone-indene resin soft, and xylene; plus a one pint sample of each of the following: venetian red, mica, diatomaceous silica, lead linoleate, lampblack, tung oil, linseed oil, and turpentine, shall be taken by the Government representative for acceptance testing by the appropriate General Services Administration (GSA) laboratory for approval prior to manufacture."

"4.2.2 When procured by Government activities in quantities of paint of 250 gallons or over, an unopened container from each lot shall be taken by the Government representative for acceptance test purposes by the appropriate GSA laboratory prior to acceptance."

"4.2.3: Delete.

#### 4.3 Test procedures. -

4.3.1 Ingredients. - All ingredients submitted shall be tested to determine compliance with the applicable specification or paragraphic description.

#### 4.3.2 Finished paint. -

4.3.2.1 The following tests when applicable shall be conducted in accordance with methods specified in FED-STD-141.

Tests	Method
Pigment (using extraction Mixture A)	4021
Volatiles	4041
Nonvolatile vehicle (calculated by difference)	4053
Water	4081
Coarse particles and skins	4092
Viscosity	4281
Weight per gallon	4184
Fineness of grind	4411
Odor	4401
Chromium as CrO <sub>3</sub>	7331
Zinc oxide as ZnO	7331

4.3.2.2 Time to dry to recoat. - Apply one coat of the paint sample using a 3-mil drawdown blade to a clean glass panel. The film is air-dried for three (3) hours in a horizontal position. Test the film with the finger using moderate pressure. The film shall be considered dry when the soft tacky condition no longer exists and the film feels firm. A film shall be considered dry for recoating when a second coat or specified topcoat can be applied without the development of any film irregularities, such as lifting or loss of adhesion of the first coat, and the drying time of the second coat does not exceed the maximum specified (if any) for the first coat.

4.3.2.3 Appearance of dried film. - The paints, prepared as specified in 4.3.2.2 shall show no evidence of wrinkling or any other film defects.

4.3.2.4 Compatibility with thinner. - Compatibility with thinner shall be determined in accordance with Method 4203 of FED-STD-141. No. 141, using 50 milliliters (ml) of paint and 50 ml. of xylene.

4.4 Acceptance of lots. - Lots shall be accepted by the Government Inspector only upon receipt of a satisfactory test report from the laboratory on samples of paint and, when necessary, on samples of ingredients.

#### "5. PREPARATION FOR DELIVERY

-(The preparation for delivery requirements specified herein apply only for direct Government procurements.)

2/ CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THIS DOCUMENT HAVE BEEN MARKED "F" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

"5.1 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in Section 7 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the the equipment is shipped.

"5.2 The paint shall be furnished in 5-gallon pails. Preparation for delivery shall conform to IT-P-143. Paint shall be packaged level A or C; packed level A, B, or C as specified (see 6.2).

MIL-P-19433A(SHIPS)

"5.3 In addition to any special marking specified in the contract or order, each container shall have affixed a warning label of appropriate size similar to Class 2 of MIL-STD-755 or shall be lithographed or stenciled with a reasonable likeness thereof. Under "contains" shall be inserted solvent xylene of 75°F. minimum flash point. For unit containers that also serve as shipping containers, any conflict with ICC regulations should be resolved by reasonable modifications of size of label or use of warning statement without label design."

6.1 Intended use. - These anticorrosive primers are intended for use on shipbottom exterior surfaces. They shall be used preferably over pretreatment primer (Formula 117, MIL-P-15328) on metal surfaces as an undercoater for antifouling paints (Navy Formulas No. 15HPN, No. 105 and 146/50). When multiple coats of primer are specified, 14N and 14ND shall be used alternately.

6.2 Ordering data. - Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Class of coating required (see 1.2).
- (c)
- (d) See SEE 5-2
- (e) Special marking required SEE 5-3
- (f) That "Before an award is made on any contract for paint under this specification, a pre-award survey will be made by a Government representative to insure that the prospective contractor meets the requirements of 3.1".

6.3 The paint should be purchased by volume, the unit being a United States gallon at 15.5°C. (60°F.).

6.4 Color Cards. - Color cards may be obtained upon application to the Laboratory Superintendent, Chemical Laboratory, Norfolk Naval Shipyard, Portsmouth, Virginia, 23704. The purpose for which the cards are desired should be specified.

6.5 Patent. - The details of this formula are covered by United States Patent No. 2,989,407 issued 20 June 1961 for which the U. S. Government has a royalty-free license.

6.6 CHANGES FROM PREVIOUS ISSUE. - THE EXTENT OF CHANGES (DELETIONS, ADDITIONS, ETC.) PRECLUDE THE ANNOTATION OF THE INDIVIDUAL CHANGES FROM THE PREVIOUS ISSUE OF THIS DOCUMENT.

Preparing activity:  
Navy - SH  
(Project 8010-N060Sh)

# SPECIFICATION ANALYSIS SHEET

IN REPLY TO NAVSHP FORM 1426

## INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractors involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse AEROPOSTAL).

SPECIFICATION

ORGANIZATION (of requester)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT

☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES

☐ NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE

DD FORM 1426  
1 APR 65

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE  
(NAVSHIPS OVERT 12-64)

GPO 600

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4 OCT 1966

MIL-P-38336(USAF)  
AMENDMENT 1  
24 March 1966

MILITARY SPECIFICATION

PRIMER COATING, INORGANIC, ZINC DUST PIGMENTED,  
SELF-CURING, FOR STEEL SURFACES

This amendment forms a part of Military Specification MIL-P-38336(USAF)  
dated 27 November 1964.

Page 2, paragraph 3.1: Add as the last sentence the following: "The  
primer may be furnished in pint, quart, half-gallon, 1 gallon  
or larger containers as specified by the procuring activity."

Page 12, paragraph 5.1.1: Delete sentence 5 and substitute: "In ad-  
dition, the companion containers of dry zinc dust and liquid  
vehicle in pint, quart, half-gallon and 1-gallon units shall  
be furnished in the same package."

Custodian:  
Air Force - 11

Preparing activity:  
Air Force - 11

Review activities:  
Air Force - 11, 69

FSC 8010



27 November 1964

## MILITARY SPECIFICATION

PRIMER COATING, INORGANIC, ZINC DUST PIGMENTED,  
SELF-CURING, FOR STEEL SURFACES

## 1. SCOPE

1.1 This specification covers a ready-to-mix, 2-component, self-curing, inorganic zinc rich primer for use on steel surfaces.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

## SPECIFICATIONS

Federal

QQ-S-698	Steel, Sheet and Strip, Low-Carbon
TT-E-781	Ethylene Glycol Monoethyl Ether, Technical
TT-P-143	Paint, Varnish, Lacquer, and Related
	Materials; Packaging, Packing, and
	Marking Of
TT-P-460	Pigment, Zinc-Dust (Metallic-Zinc-
	Powder) Dry
TT-S-735	Standard Test Fluids; Hydrocarbon
UU-T-106	Tape, Pressure-Sensitive Adhesive,
	Masking, Paper

Military

JAN-H-792	Humidity Cabinet, Operation Of
MIL-A-4091	Alcohol, Ethyl, Specially Denatured,
	Aircraft
MIL-L-7808	Lubricating Oil, Aircraft Turbine
	Engine, Synthetic Base

## STANDARDS

Federal

Fed. Test Method	Paint, Varnish, Lacquer, and Related
Std No. 141	Materials; Methods of Inspection,
	Sampling, and Testing

Military

MIL-STD-129

Marking For Shipment And Storage

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. REQUIREMENTS

3.1 Components. The inorganic zinc rich primer shall be a ready-to-mix, 2-component material. The 2-component material shall be furnished in separate companion containers; the dry zinc dust shall be in 1 container and the liquid inorganic vehicle in the other container. The container size, where specified, shall refer to the liquid vehicle container which shall hold enough of the vehicle to provide the specified volume of the mixed primer. For example, a 1-gallon container shall be of the standard 1-gallon size and shall contain an adequate amount of liquid vehicle to provide a minimum of 231 cubic inches of the mixed primer.

3.2 Materials. The manufacturer is given latitude in the selection of raw materials and processes of manufacture but shall be restricted by the requirements of this specification. The materials used shall be of high quality and entirely suitable for the purpose intended.

3.2.1 Toxic products and formulations. The material shall have no adverse effect on the health of personnel when used according to provided instructions and for its intended purpose. Questions pertinent to this effect shall be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring agency.

3.2.2 Zinc dust pigment. The zinc dust pigment shall conform to the requirements of TT-P-460, type II.

3.2.3 Liquid vehicle. When the liquid inorganic vehicle portion of the primer cannot be thinned with water, organic solvents as specified herein shall be used as a diluent.

3.2.3.1 Thinner. Denatured ethyl alcohol conforming to MIL-A-4091 or ethylene glycol monoethyl ether (Cellosolve) conforming to TT-E-781 shall be used as required for thinning the primer.

3.2.3.1.1 Denatured ethyl alcohol. Denatured ethyl alcohol shall be used only when applying the organic solvent dilutable primer to structures located in outside environments. The application procedure is necessary because of the potential fire hazard created by the low flash point of ethyl alcohol.

3.2.3.1.2 Ethylene glycol monoethyl ether (Cellosolve). Ethylene glycol monoethyl ether shall be used when applying organic solvent dilutable primers within enclosed areas such as missile silos. The higher flash point of ethylene glycol monoethyl ether decreases fire hazards.

3.3 Quantitative requirements. The primer shall meet the quantitative requirements specified in table I.

TABLE I. Quantitative Requirements of Primer

Characteristic	Minimum Requirements
Nonvolatile (solids) content, percent by weight, of vehicle	32
Zinc content, percent by weight, total zinc solids of zinc dust pigmented primer	80
Flash point, °F, of ethyl alcohol diluted primer	65
Flash point, °F, of ethylene glycol monoethyl ether diluted primers	145
Weight per gallon in pounds	18

#### 3.4 Qualitative requirements

3.4.1 Mixing. When tested as specified in 4.6.4, the zinc dust pigment shall be easily mixed, by hand, into the inorganic vehicle to form a smooth, homogeneous material free from lumps or other objectionable characteristics.

3.4.2 Odor. When tested as specified in 4.6.1, the odor of the wet primer and the dry film shall not be obnoxious.

3.4.3 Coarse particles and skins. When tested in accordance with 4.6.1, the percentage of coarse particles and skins retained on the sieve shall not exceed by more than 0.5 percent the total amount of residue retained when the dry zinc pigment is subjected to the sieve test.

3.4.4 Primer stability. When tested after standing undisturbed for 8 hours as specified in 4.6.5, the primer shall not have aged or settled to the extent that it cannot be easily redispersed into a smooth, homogeneous mixture by hand mixing.

3.4.5 Miscibility with thinner. When tested in accordance with 4.6.1, primers requiring dilution with organic solvents shall be compatible with denatured ethyl alcohol conforming to MIL-A-6091 and with ethylene glycol monoethyl ether conforming to TT-E-781 in ratios up to one part of thinner to one part of mixed primer by volume. Primers which are to be diluted with water shall be compatible with the water when mixed in the same ratios.

3.4.6 Storage stability. At the time of submission of bid, the manufacturer shall certify that after 1 year's storage at a temperature of  $90^{\circ} \pm 10^{\circ}$  F, the primer shall meet all the requirements of this specification.

### 3.5 Coating

3.5.1 Film properties. The coating shall be at least  $3.5 \pm 0.5$  mils in dry film thickness and shall be smooth, even and free of runs, sags, streaks or other imperfections.

3.5.2 Application methods. The primer shall be applied by spraying or brushing over solvent cleaned, phosphoric acid treated or sand blasted steel.

3.5.2.1 Dry surfaces. When tested in accordance with 4.6.6, the coating shall be applied without "mud-cracking" or loss of adhesion.

3.5.2.2 Wet surfaces. When tested in accordance with 4.6.6, the coating shall cure on wet steel surfaces and on surfaces located in environments of  $90^{\circ}$  F and 95 percent relative humidity.

#### 3.5.3 Drying time

3.5.3.1 Dry surfaces. A film of the primer, prepared and tested in accordance with 4.6.7, shall dry dust free in not more than 30 minutes and shall dry through in not more than 4 hours.

3.5.3.2 Wet surfaces. A film of the primer, prepared and tested in accordance with 4.6.7, shall cure dust free in not more than 1 hour and cure through in not more than 6 hours.

3.5.4 Flexibility. When tested in accordance with 4.6.8, a film of the primer shall show no cracking or loss of adhesion in the bend area.

3.5.5 Adhesion. When tested in accordance with 4.6.9, coatings of the primer shall show no lifting, flaking or other signs of damage.

3.5.6 Fluid resistance properties

3.5.6.1 Water resistance. When tested as specified in 4.6.10.1, the primer shall show no wrinkling, blistering, loss of adhesion or other visible defects.

3.5.6.2 Hydrocarbon resistance. When tested as specified in 4.6.10.2, a film of the primer shall show no wrinkling, blistering, loss of adhesion or other visible defects.

3.5.6.3 Synthetic fluid resistance. When tested as specified in 4.6.10.3, a film of the primer shall show no wrinkling, blistering, loss of adhesion or other defects.

3.5.7 Weathering properties

3.5.7.1 Accelerated weathering. When tested as specified in 4.6.11, the primer shall not be adversely affected by 30 days accelerated weathering.

3.5.7.2 Weather exposure. At the time of submission of bid, the manufacturer shall certify that a single coat of the primer, 3.5  $\pm$  0.5 mils in dry film thickness, shall provide adequate protection for steel surfaces for a minimum of 2 years without loss of adhesion, blistering or rust pitting when exposed in the vicinity of coastal, salt water atmospheres.

3.5.8 Humidity resistance. When tested in accordance with 4.6.12, a coating of the primer shall show no blistering, wrinkling, or loss of adhesion.

3.5.9 Salt spray resistance. When tested in accordance with 4.6.13, a coating of the primer shall show no blistering, wrinkling, or loss of adhesion. There shall be no general surface corrosion, pitting, or other visual evidence of panel corrosion.

3.5.10 Inhibitive properties. When tested in accordance with 4.6.14, a primer coated panel shall inhibit the spread of corrosion beyond a maximum of 1/32 inch on either side of the score line (a total width of 1/16 inch).

3.5.11 Topcoating properties. When tested in accordance with 4.6.15, the primer shall provide a suitable base for topcoating with additional coats of primer of like material.

3.5.12 Heat resistance. When tested in accordance with 4.6.16, the primer shall not be adversely affected by a 24-hour bake at 750° F.

3.5.13 Color. The preferred color of the cured primer is the characteristic metallic color of the zinc pigment which approximates color No. 36231 of Federal Standard No. 595. However, other colors resulting from the use of additional inhibitive pigments such as red lead and zinc chromate shall not be cause for rejection provided the primer meets all other requirements of this specification.

3.6 Workmanship. The ingredient materials shall be intimately assembled and processed as required in accordance with the best practice for the manufacture of a high quality primer.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests. The inspection and testing of the inorganic vehicle, zinc dust pigmented primer, shall be classified as quality conformance tests.

4.3 Sampling. Sampling, inspection, and testing shall be conducted in accordance with the provisions of Federal Test Method Standard No. 141, method 1031, and as specified herein.

#### 4.4 Test panels

4.4.1 Material. Test panels shall be prepared from sheet steel conforming to QQ-C-698, cold-rolled, and may be of any convenient size and thickness subject to the following limitations:

a. Unless otherwise specified, panels shall be at least 4 inches wide by 6 inches long.

b. Panels for the flexibility tests shall be  $22 \pm 2$  mils thick.

c. Other test panels shall be not less than 30 nor more than 60 mils thick.

#### 4.4.2 Surface preparation

4.4.2.1 Solvent-cleaned panels. Test panels shall be selected from smooth steel free from rust. The panels shall be scoured with steel wool, washed in solvent (acetone, methyl ethyl ketone, toluene, or

trichloroethylene) and then rinsed in clean solvent. After the panels have air-dried, they shall be wiped clean with a solvent-dampened, clean, lint-free cloth.

4.4.2.2 Phosphoric-acid-cleaned panels. The test panels selected shall be free from other than light rusting. They shall be scoured with steel wool to remove rust or other adhering contamination, washed in solvent as in 4.4.2.1, rinsed in clean solvent, and air-dried. The panels shall then be treated as follows:

a. Immerse for 2 hours in an acid cleaner of the following composition maintained at a temperature of  $75^{\circ} \pm 2^{\circ} \text{ F}$ :

3150 ml of water  
650 ml of technical grade, 85 percent phosphoric acid  
3.8 grams of diethyl 1, 3, thiourea  
1.4 grams of alkyl aryl sulfonate wetting agent.

b. Rinse in water and immerse for 15 minutes in the following dichromate solution maintained at a temperature of  $75^{\circ} \pm 2^{\circ} \text{ F}$ :

3785 ml of water  
114 grams of potassium dichromate

c. Force dry the panels at a temperature of  $190^{\circ}$  to  $212^{\circ} \text{ F}$ .

4.4.2.3 Sand-blasted panels. The panels shall be washed in solvent as specified in 4.4.2.1, rinsed in clean solvent, and dried. The entire panel shall be blasted using any suitable equipment and blasting material. The blasting material shall be free from oil, grease, dirt, water, or other contaminants that would impair the coatability of the panel surface. The panels shall be blast cleaned to a white metal. After blasting, the panels shall be cleaned by using clean, dry compressed air or a vacuum.

#### 4.4.3 Application methods

4.4.3.1 Dry surfaces. After preparation specified in 4.4.2, the panels shall be kept clean and free from fingerprints, rust, etc. Application of the primer shall be accomplished within a maximum of 1 hour after cleaning, or the cleaned panels may be stored in clean toluene or a desiccator for not more than 72 hours prior to coating. The primer shall be thoroughly mixed and thinned in accordance with the manufacturer's instructions. Unless specified a single coat of the primer shall be applied by spray or brush using a wet cross-coat, to a dry film thickness as specified in 3.5.1. The panel shall be in a nearly vertical position during spraying and for at least 2 minutes

after completion of spraying. Panels that are to be used for salt spray, humidity, or other tests where corrosion or rusting of the panel is a factor shall be coated on both sides and, in addition, shall be dipcoated around the edges to a distance of approximately 1/8 inch. The coated panels shall be air dried for a minimum of 2 hours and not more than 4 hours prior to testing (see 4.6).

4.4.3.2 Wet surfaces. The panels shall be prepared and coated as specified in 4.4.3.1 except the panel surfaces shall be wet prior to primer application. The test panels shall be dipped in tap water, removed, and with a damp fine-pore cellulose sponge smoothed to a bright, even coat of water. The panels shall then be immediately spray or brush coated with the primer and placed in a humidity cabinet at 90° F and 95 percent relative humidity. Test panels shall cure dust free in 1 hour and cure through in not more than 6 hours. After curing, the panels shall be removed from the humidity cabinet and tested as specified in 4.6.

4.5 Test conditions. Unless otherwise specified, all testing, conditioning, curing, etc., shall be conducted under standard laboratory conditions of 75° ± 2° F and 50 ± 5 percent relative humidity.

#### 4.6 Test methods

4.6.1 The tests of this specification shall be conducted in accordance with the applicable methods of Federal Test Method Standard No. 141, as listed in table II, and other methods as described in 4.6.2 through 4.6.18.

TABLE II. Test Methods

Test	Requirements Reference	Fed. Std. No. 141 Method No.
Nonvolatile (solids) content	Table I	4041 or 4042
Flash point	Table I	4291
Odor	3.4.2	4401
Coarse particles and skins	3.4.3	4091
Miscibility	3.4.5	4201
Weight per gallon	Table I	4184
Color	3.5.13	1/ 4250

1/ Deviation from color No. 36231 of Federal Standard No. 595 shall not be cause for rejection.

4.6.2 Zinc dust pigment. The dry zinc dust pigment shall be tested according to the requirements of TT-F-460.



**4.6.3 Zinc content.** The percentage of zinc dust in the dry film shall be determined as follows: Using one unopened unit of primer (one container of liquid vehicle and the companion container of dry zinc dust) accurately determine the total weight of each component by comparing the weight of the full containers to that of identical, empty, clean containers. Determine the nonvolatile content of the liquid vehicle according to the method listed in table II. Calculate the percent of zinc dust in the dry film as follows:

$$\frac{A \times 100}{A + \frac{(B \times C)}{100}} = D$$

A = Weight of zinc dust

B = Percentage of nonvolatile in the vehicle

C = Weight of vehicle

D = Percentage of zinc in the dry film.

**4.6.4 Mixing.** A 1-quart sample of the primer shall be mixed according to the manufacturer's instructions. The material shall be briskly stirred, by hand, during the mixing. The complete mixing shall be accomplished in not more than 5 minutes. After the mixture appears homogeneous or at the end of the 5-minute period, whichever occurs first, the material shall be allowed to stand for 1 minute. It shall then be poured slowly into another container. The primer shall be observed during pouring and the residue remaining in the mixing container observed for any evidence of lumps or pigment that has not been wetted by the liquid vehicle.

**4.6.5 Primer stability.** A 1-quart container shall be filled to within approximately 1/2 inch from the top with well-mixed primer. The container shall be sealed and stored at 75° ± 2° F undisturbed for 6 hours. At the end of this period, the container shall be opened and the primer handmixed for not more than 3 minutes. There shall be no evidence of undispersed lumps of pigment remaining after completion of the stirring. (Small amount of pigment clinging to the stirrer shall not be cause for rejection.)

**4.6.6 Coating.** Panels shall be prepared, cleaned, and coated in accordance with 4.4.1, 4.4.2 and 4.4.3 respectively. The coated panels shall be examined for conformance with 3.5.1.

**4.6.7 Drying time.** The drying time of the primer shall be determined in accordance with method 4061 of Federal Test Method Standard No. 141 except that the primer shall be sprayed on a solvent-cleaned steel panel, as specified in 4.4.2.1 to a dry film thickness as specified in 3.5.1. The drying time shall be in accordance with 3.5.3.

4.6.8 Flexibility. Solvent-cleaned panels coated with primer as specified in 4.4.3 and cured as applicable shall be bent 180 degrees over a 1-inch mandrel in accordance with method 6221 of Federal Test Method Standard No. 141. Similar panels shall be conditioned for 1 hour at 0° F and while still at that temperature bent around a 4-inch diameter mandrel. The panels shall be visually examined immediately for evidence of failure, and then after conditioning to room temperature shall be re-examined to determine compliance with 3.5.4.

4.6.9 Adhesion tests of primer coated panels

4.6.9.1 Unexposed and exposed to aqueous media. Test panels cleaned by each of the three methods in 4.4.2 shall be coated with the primer and cured as specified in 4.4.3. Two parallel scratches down to metal, using a stylus, shall be made 1 inch apart. A 1-inch wide strip of masking tape conforming to UU-T-106 shall be applied, adhesive side down, across the scratches. The tape shall be pressed down using two passes of a 4-1/2 pound rubber-covered roller approximately 3-1/2 inches in diameter by 1-3/4 inches in width, the surface of which has a durometer hardness value within the range of 70 to 80. The roller shall be moved at the rate of approximately 1 inch per second. The tape shall be removed in one abrupt motion with the pull exerted at approximately a 90-degree angle to the panel, and the panel examined for removal of primer from the metal. Stripping of the tape shall be accomplished immediately after application.

4.6.9.2 Exposed to nonaqueous media. Tests shall be in accordance with method 6303 of Federal Test Method Standard No. 141.

4.6.10 Fluid resistance properties. Test panels prepared, coated and cured as specified in 4.4 shall be half immersed in the fluids (see 3.5.6) and tested in accordance with method 6011 of Federal Test Method Standard No. 141. Resistance properties shall conform to the requirements of 3.5.6.

4.6.10.1 Water resistance. Immersion in distilled water shall be 14 days at 75° F. Twenty-four hours after removal from water, the immersed portion of the film shall be equal in hardness and adhesion to the unimmersed portion as determined in 4.6.9.1.

4.6.10.2 Hydrocarbon resistance. Immersion in fluid conforming to TT-S-735, type III, shall be 24 hours at 75° F. Twenty-four hours after removal, the immersed portion of the film shall be equal in hardness and color to the unimmersed portion as determined in 4.6.9.2.

4.6.10.3 Synthetic fluid resistance. Immersion in fluid conforming to MIL-L-7808 shall be 168 hours at 160° F. Twenty-four hours after removal, the immersed portion of the film shall be equal in hardness and color to the unimmersed portion as determined in 4.6.9.2.

4.6.11 Accelerated weathering. Test panels prepared, cleaned and coated with primer, as specified in 4.4, shall be subjected to 300 hours exposure to accelerated weathering in accordance with method 6152 of Federal Test Method Standard No. 141. Following this exposure, the panels shall be inspected for loss of flexibility, blistering, loss of either intercoat or metal adhesion, or any other apparent defects. (Slight whitening of the film shall be disregarded.)

4.6.12 Humidity resistance. Panels prepared by each of the three cleaning methods specified in 4.4.2 shall be coated with primer and cured as specified in 4.4.3. The panels shall be exposed in a humidity cabinet conforming to JAM-H-792 and operated at  $120^{\circ} \pm 2^{\circ}$  F and 100 percent humidity. The primer shall be exposed for 30 days. After exposure the panels shall be examined for conformance to 3.5.8.

4.6.13 Salt spray. Panels shall be prepared, cleaned, coated with primer and cured as specified in 4.4. They shall then be exposed in accordance with method 6061 of Federal Test Method Standard No. 141 except that they shall not be scored. Exposure time shall be 30 days.

4.6.14 Inhibitive properties. Panels shall be prepared, cleaned, coated, cured and exposed as specified in 4.6.13 except that they shall be scored and the time of exposure shall be 30 days. After the exposure period, the panels shall be removed, washed in water without scrubbing, allowed to dry, and examined for conformance to 3.5.10.

4.6.15 Topcoating properties. A solvent cleaned panel shall be coated and cured in accordance with 4.4. After curing the panel shall be coated with an additional  $1.0 \pm 0.5$  mil dry film thickness of the primer. The additional coat of the primer shall also be cured as specified in 4.4. The panel shall then be tested in accordance with 4.6.9.1 and inspected for adhesion of the second coat to the initial coat of primer.

4.6.16 Heat resistance. Panels cleaned with solvent, coated with primer, and cured as specified in 4.4 shall be exposed in an oven to a temperature of  $750^{\circ} \pm 5^{\circ}$  F for 24 hours. The panels shall then be removed and conditioned to room temperature. The coating shall be tested for adverse effects by the flexibility test, 4.6.8, and the humidity test, 4.6.12. Performance of the oven-exposed coating shall be equal to or better than the unexposed coating.

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4.6.17 Toxicological data and formulations. The supplier shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use.

4.6.18 Packaging, packing and marking. Preparation for delivery shall be examined for conformance with section 5.

#### 5. PREPARATION FOR DELIVERY

~~5.1~~ Packaging. ~~Packaging shall be level A, B or C as specified (see 6.2).~~

~~5.1.1~~ Level A. The primer shall be packaged according to the requirements of TT-P-143. The dry zinc dust and the liquid vehicle shall be packaged in separate containers. Quantities in each of the containers shall be such that the entire contents of one container shall be mixed with the entire contents of the companion container to provide the correctly proportioned mixed primer. (For liquid vehicle containers larger than 5 gallons the appropriate amount of zinc dust may be packaged in two or more containers.) In addition, the companion containers of dry zinc dust and liquid vehicle, for units up to and including 1-gallon size, shall be packed together in the same package. One container of liquid vehicle and the companion container of dry zinc dust shall be considered as one unit of primer.

~~5.1.2~~ Level C. Packaging shall be in accordance with the manufacturer's commercial practice.

~~5.2~~ Packing. Packing shall be level A, B or C as specified (see 6.2).

~~5.2.1~~ Level A. The primer shall be packed in overseas type shipping containers according to the requirements of TT-P-143.

~~5.2.2~~ Level B. The primer shall be packed in domestic type shipping containers according to the requirements of TT-P-143.

~~5.2.3~~ Level C. The primer shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Rules or regulations of other carriers applicable to the mode of transportation.

~~5.3~~ Marking. Interior and exterior containers shall be marked in accordance with the requirements of MIL-STD-129. In addition, individual containers shall be marked, either by stencil or durably attached labels, with mixing, thinning, application, and curing instructions, as applicable. Each dry zinc dust container shall bear the following information:

PRIMER COATING, INORGANIC, ZINC DUST PIGMENTED, SELF-CURING,  
FOR STEEL SURFACES

Specification MIL-P-28336(USAF)

Mix entire contents of this container  
with \* (amount) of formula No. \*  
liquid vehicle.

\*Manufacturer shall enter appropriate data.

*In addition:*  
~~Precautionary marking.~~ Each container of liquid vehicle  
shall be marked with the following precautionary marking:

DO NOT STORE AT TEMPERATURES ABOVE 100° F.

~~Labeling.~~ Labeling shall be required in accordance with the  
requirements of appropriate Federal Statutes and Regulations, e.g.,  
Federal Hazardous Substance Labeling Act, etc., or as prescribed by  
the processing agency upon advice and recommendations of the  
departmental medical services.

## 6. NOTES

6.1 Intended use. The inorganic zinc rich primer covered by this  
specification is for use on surfaces of steel structures that receive  
severe exposure to adverse weather, condensing moisture, corrosive  
atmospheres and marine environments. The primer may be applied  
under conditions of high humidity and condensing moisture.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number and date of this specification.
- b. That the unit of purchase and sale be the U. S. gallon of  
231 cubic inches of mixed primer at 77° F.
- c. Applicable levels of packaging and packing (see 5.1 and 5.2).
- d. Required type and size of container.

Custodian:  
Air Force - 11

Preparing activity:  
Air Force - 11

Review activities:  
Air Force - 11, 69

User activity:  
Air Force - 69

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL		OMB Approval No. 22 R255
<b>INSTRUCTIONS:</b> The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.		
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94 OCT 1962

MIL-P-23236(SHIPS)  
28 June 1962

MILITARY SPECIFICATION  
PAINT COATING SYSTEMS, STEEL SHIP TANK,  
FUEL AND SALT WATER BALLAST

## 1. SCOPE. -

1.1 Scope. - This specification covers paint coating systems for use on all steel shipboard tanks used for fuel and salt water ballast.

1.2 Classification. - Coating systems shall be of the following types and classes, as specified (see 6.1 and 6.2):

Type I - New and complete application.  
Type II - Maintenance.

1.2.1 Types I and II shall be furnished in the following classes, as specified (see 6.1 and 6.2):

Class 1 - Epoxy.  
Class 2 - Coal tar - Epoxy ~~not required for aviation fuel tanks~~.  
Class 3 - Silicate, phosphate or silicone zinc.  
Class 4 - Urethane.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitations for bids, form a part of this specification to the extent specified herein:

## SPECIFICATIONS

## FEDERAL

TT-N-95 - Naphtha, Aliphatic.  
TT-P-143 - Paint, Varnish, Lacquer and Related Materials, Packaging, Packing, and Marking of.  
TT-T-548 - Toluene; Technical.  
TT-X-916 - Xylene (For Use in Organic Coatings).  
VV-B-231 - Benzene (Benzol) Technical.

## MILITARY

MIL-G-5572 - Gasoline, Aviation: Grades 80/87, 91/96, 100/130, 115/145.  
MIL-J-5624 - Jet Fuel, Grades JP-3, JP-4, JP-5.  
MIL-L-18389 - Lacquer, Vinylidene Resin, Water And Fuel Resistant, White And Orange, Formula No. 113/54.  
MIL-L-19868 - Labels, Paper, Pressure Sensitive Adhesive (For Hazardous Industrial Chemicals And Materials).

## STANDARDS

## FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.





MIL-P-23236(SHIPS)

AMERICAN SOCIETY FOR TESTING MATERIALS

D130-56 - Method of Test For Copper Strip Corrosion By Petroleum Products.

D156-53T - Method of Test For Saybolt Color of Petroleum Products (Saybolt Chromometer Method).

D381-61T - Method of Test For Existent Gum In Fuels By Jet Evaporation.

----- - Petroleum Products and Lubricants - D2, Vol. 1, 37th Edition, Oct. 1960.

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.)

3. REQUIREMENTS

3.1 Qualification. - The coating system furnished under this specification shall be a product which has been tested, and passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Materials. - The coating system shall be composed of the following vehicles for each class, pigment, formulated, and manufactured to produce a uniform, high quality product capable of meeting all the requirements of this specification.

3.2.1 Class 1, epoxy. - Class 1, epoxy coating system shall be composed principally of an epoxy resin converted with amines or other suitable materials (see 6.1).

3.2.2 Class 2, coal tar-epoxy. - Class 2 coal tar-epoxy coatings shall be composed principally of a refined coal tar-coal tar pitch and a minimum of 17 percent (by weight of coating) of an epoxy resin converted with amines or other suitable materials (see 6.1).

3.2.3 Class 3, silicate, phosphate or silicone zinc. - Class 3 zinc coating system shall be composed principally of an inorganic silicate, phosphate or silicone with zinc, which may be both free and combined. (see 6.1).

3.2.4 Class 4, urethane. - Class 4 urethane coating system shall be composed principally of a polyurethane resin converted with amine or other suitable material (see 6.1).

3.3 Color. - Class 1 and class 4 coating system shall be composed of coats having a 45 degree directional reflectance of not less than 30 with exception of the prime coat. Succeeding coats shall be of contrasting color, and the top or finish coat shall be white or a very light pastel shade. The color of class 2 and 3 coating systems shall be characteristic of the ingredients and uniform, lot to lot.

3.4 Description. - The coating system shall be kept to the minimum number of coats compatible with superior performance. In no case shall more than four coats be required. Where coatings are composed of components to be mixed at the time of application, the minimum proportions for any component shall be at least 5 percent by volume of the total.

3.5 Pot life. - The pot life of the coatings of the coating system, mixed and ready for application, shall be a minimum of four hours at 70° Fahrenheit (F.) and 80 percent relative humidity when tested in accordance with 4.3.1.5.

3.6 Drying or curing time. - All coatings of the coating system shall require no more than 24 hours between coats when applied at a temperature of 50°F. and shall be ready for service within 7 days after the application of the last coat (see 4.3.1.4).

3.7 Flash point. - Coatings shall not flash at temperatures lower than 100°F. when tested in accordance with 4.3.1.4.

3.8 Application characteristics. - All coatings of the coating systems shall be readily applied by brush or spray using commercially available spray equipment. The coatings shall exhibit reasonable leveling without excessive sagging when applied at proper film thickness (recommended by the manufacturer). Adhesion between coats shall be adequate for performance in service without undue restrictions concerning timing, temperature or other conditions associated with application.

3.9 Immersion resistance. - The coating system, when tested in accordance with 4.3.1.6, shall show no film failure other than moderate change in appearance and a maximum failure of 3 percent of the total area. Pinhole rusting, loss of adhesion, blisters larger than 1/16 inch in diameter or blisters that grow appreciably in numbers or size as the test progresses shall be considered failure. Very fine blisters or surface imperfections that may appear during the first 10 cycles of the test but, whose rate of growth is negligible or very slow shall not be counted in the percentage area of failure. On the recoated area, adhesion of the added coating, readily discerned to be less than half the adhesion between the original coats shall be considered failure in addition to the above considerations.

3.10 Service. - The coating system shall show no film failure other than moderate change in appearance and a maximum failure of 5 percent of the total area of the tank when tested in accordance with 4.3.1.7. Pinhole rusting, loss of adhesion, and blisters larger than 1/16 inch in diameter shall be considered failure.

3.11 Service use. - The coating system shall continue to provide excellent protection against corrosion without excessive touch-up for a minimum period of 3 years.

3.12 Condition in container. - The coatings of the coating systems shall be usable, shall be readily broken up with a paddle to a smooth uniform consistency, shall not liver, increase more than one-third in viscosity measured in Krebs units (or alternately shall have no viscosity increase which cannot be compensated for by addition of a maximum of 5 percent of thinner similar to that used in the coating), or increase more than one-fifth in time of dry, nor show any other objectionable properties for at least six months for type I and one year for type II after date of manufacture.

3.13 Toxicity. - All the coatings of the coating system shall be readily applied to a tank surface with no appreciable toxicological effect on personnel and shall produce no more than a mild dermatitis if contact is made with the skin during mixing of the coating components.

3.14 Identification characteristics. - Values for identification characteristics shall be provided by individual suppliers for characteristics as indicated by "X" in table I. The values shall be established for each coating system prior to qualification approval. The purpose of these values is to serve as a basis for determining that the material being offered is essentially the same as that which was approved under qualification testing. Subject to approval by the Bureau of Ships, alternate means of identification (for example, infra-red spectrographic examination, chemical analysis, and so forth) may be substituted for the characteristics in table I provided appropriate data is submitted by the supplier.

Table I - Identification characteristics values.

Characteristic	Coating component (Note 1)	Coating (Note 2)	Coating System (Note 3)
Chemical nature	X		
Percent of principal constituents (15 percent or more of total)	X		
Percent pigment	X (Note 4)		
Percent non-volatile vehicle	X (Note 4)		
Percent volatile	X		
Weight per gallon	X	X	
Color	X	X	
Viscosity	X	X	
Flash Point	X	X	
Fineness of grind	X (Note 6)	X	
Odor	X	X	
Pot life		X	

Table I - Identification characteristics values (Cont'd.)

Characteristic	Coating component (Note 1)	Coating (Note 2)	Coating System (Note 3)
Drying or curing time		X	X
Gloss and appearance		X	X
Recoatibility		X (Note 4)	X (Note 4)
Adhesion		X (Note 4)	X (Note 4)
Flexibility		X	X
Resistance to boiling water immersion (identification standard)			X (Note 4)
Resistance to fuel and water at 90° F. (accelerated performance test)			X (Note 4)
Mixing instructions		X (Note 5)	
Application instructions			X (Note 5)

## Notes:

1 - Coating components are individually packaged components such as base component, converter component or hardener, liquid portion, powder portion, curing solution, and so forth. Indicate only applicable characteristics. For example, percent pigment is not applicable to curing solutions.

2 - Coatings for class 1, 2, and 4 are the resin base and converter as mixed for application. Coating for class 3 is powder portion mixed with liquid portion.

3 - Coating system is total system (number and type of coats and approximate dry film thickness as tested for qualification approval). Class 3, self-curing single coat applications shall be considered both as a coating and coating system. Other class 3 coating systems shall consist of the "powder and liquid" coat followed by a curing coat.

4 - Not required for each lot. Shall be run at least once every six months.

5 - Required once only. Should be furnished with request for test.

6 - For fine dust component of class 3 systems, report percent retained on U. S. Standard No. 32 sieve.

3.15 Adhesion to aged vinylidene resin lacquer film, type II only. - The coating system shall be compatible in every respect with the aged lacquer film conforming to MIL-L-18288 and show no loss of adhesion, pimpling or blistering when tested in accordance with 4.3.1.12.

3.16 Aviation fuel compatibility (not required for class 2). - Coating systems shall not contribute particulate or chemical contamination which is detrimental to subsequent logistics or aircraft operation when tested in accordance with 4.3.1.13. Particulate contamination occurs when solides, color bodies and fuel reaction bodies are leached from the coating whereas chemical contamination evidences itself when the fuel becomes corrosive, shows increased existent gum or suffers a loss in diethylene bromide.

3.16.1 Color. Effect of coating system on color of fuel shall be negligible when tested in accordance with 4.3.1.13.2. For JP-5 fuel Saybolt color difference shall not exceed 2. For aviation gas, there shall be no perceptible difference in color, turbidity or precipitation.

3.16.2 Corrosion. JP-5 fuel and aviation gas shall not become corrosive after contact with coating system when tested in accordance with 4.3.1.13.3.

3.16.3 Existent gum. Effect of coating system on existent gum shall be negligible when tested in accordance with 4.3.1.13.4. The difference in existent gum (unwashed) shall not exceed 4.0 mg/100 mil. The difference in existent gum (washed) shall not exceed 2.0 milligram (mg)/100 mil.

3.16.4 Solids (total sediment). - The effect of coating system on total sediment shall be negligible when tested in accordance with 4.3.1.13.5. The difference in total sediment shall not exceed 2.0 mg/liter.

3.16.5 Bromine. - The effect of coating system on ethylene dibromide content of aviation gas shall be negligible when tested in accordance with 4.3.1.13.6. The difference in bromine content shall not exceed 10 percent.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality assurance shall be provided in accordance with method 1031 of FED-STD-141.

#### 4.3 Test procedures. -

4.3.1 Testing under this specification shall be for the purpose of:

- (a) Qualification.
- (b) Quality conformance inspection.

4.3.1.1 Qualification tests. - Qualification tests shall consist of all tests specified in this specification. All tests other than those for compliance with requirements of 3.10 and 3.11 (see 4.3.1.7) shall be made by the supplier. After satisfactory completion of tests, the supplier shall submit the results of the tests with actual value showing compliance with 3.2 through 3.9 with a request for the service test specified in 4.3.1.7. Sufficient material to apply a complete coating system over an area up to 5,000 square feet will be required. The service test will be conducted on a Naval ship or as an alternate, consideration will be given to commercial applications recommended by the supplier and deemed equivalent by the Bureau of Ships.

4.3.1.1.1 Qualification approval. - To be granted qualification approval the material must pass the 18 months service test specified in 4.3.1.7.

4.3.1.1.2 Qualification retention. - Qualification retention will be based upon compliance with the 3 years service use requirements in 3.11 based on the durability data from tank performance records referred to in 6.4. At any time after the 18 months service the records indicate the coating system has failed the supplier will be notified.

4.3.1.2 Quality conformance inspection. - Quality conformance inspection shall consist of all tests required for identity (see 3.14).

4.3.1.3 Panel preparation. - Test plates of the nature and size specified in FED-STD-141 for the specified test method shall be prepared in accordance with the supplier's application instructions. The individual coatings shall be mixed in accordance with the supplier's mixing instructions.

4.3.1.4 The following tests shall be conducted in accordance with FED-STD-141:

Test	Applicable method
Pigment	4021 (using suitable extraction mixture)
Volume	4041

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REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS, (II)

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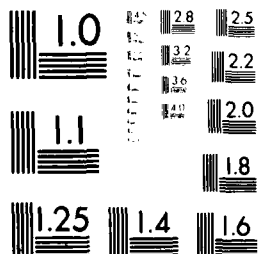
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

MIL-P-23236(SHIPS)

<u>Test</u>	<u>Applicable method</u>
Nonvolatile vehicle (calculated by difference)	4058
Viscosity	4281
Weight per gallon	4184
Fineness of grind	4411
Flash point	4293
Odor	4401
Color (quality conformance inspection)	4250
Color (qualification)	4251 or 4252
Directional reflectance (green filter)	6121
Drying (curing) time	4061
Flexibility (conical mandrel)	6222
Application (as modified by supplier's instruction)	2131 or 2141
Condition in container	3011
Gloss <sup>1/</sup>	6101

<sup>1/</sup> The panel prepared for gloss shall also be visually examined for surface smoothness, irregularities and appearance.

4.3.1.5 Pot life.- The coatings of the coating system shall be mixed from the components, in accordance with the suppliers instructions, in a suitable container so as to result in approximately one quart of finished material. For routine testing, ambient conditions above 70°F. and 50 percent relative humidity shall be satisfactory. For referee tests, 70°F.  $\pm$  5°F. and 80  $\pm$  10 percent relative humidity shall prevail. The time between mixing and the loss of adequate brushing and spraying properties shall be determined. Report up to a 48 hour period the actual temperature, humidity and the time of loss of adequate brushing and spraying properties.

4.3.1.6 Immersion resistance.- The coating system shall be applied in accordance with the supplier's instructions and consonant with 3.4 so as to coat completely two 6 x 12 x 1/8 inch blasted hot rolled mild steel plates. The blast pattern shall approximate 3 mils depth for coating systems of at least 5 mils thickness and 1.5 mils for systems less than 5 mils thick, have completely removed all mill scale, rust and rough edges and be similar to the average areas encountered in blasted tanks prior to coating. Unless otherwise specified 24 hours dry time shall be allowed between coats and one week at 70°F., or equivalent between the last coat and first immersion.

4.3.1.6.1 The coated panels shall be subjected to 20 cycles (or to prior failure) of the following test:

(a) Test cycle for evaluating tank coating.- The cycle comprises four operations carried out in the order specified:

(1) Salt water immersion for one week.- Immerse panels totally for one week in 3.0 percent salt water solution comprised of commercial table salt dissolved in distilled water, at temperature of 80°F.  $\pm$  10°F.

- (2) Aromatic fuel immersion for one week. - Following salt water immersion, immerse panels totally for one week in a 40 percent aromatic synthetic gasoline comprising a blend of 60 volumes aliphatic petroleum naphtha, conforming to TT-N-95, 20 volumes toluene conforming to TT-T-548, 15 volumes xylene conforming to TT-X-916, and 5 volumes benzene conforming to VV-L-231 at a temperature of 80°F.  $\pm$  10°F.
- (3) Hot sea water immersion for two hours. - (This operation and the operation following is intended to simulate conditions encountered in the use of tank cleaning and devaporizing equipment.) Following fuel immersion, immerse panels totally in hot synthetic sea water for two hours at 175°F.
- (4) Hot sea water spray for ten seconds. - Following the hot synthetic sea water immersion, place each panel within a suitable closed container and opposite a 3/16 inch spray nozzle set at a distance of 2-1/2 feet from the panel face. At a nozzle pressure of 25 pounds per square inch (p.s.i.), spray each panel dead center with a blast of hot synthetic sea water (175°F) for a period of ten seconds.

NOTE: Operation (1) to (4) constitute one (1) complete test cycle. This cycle is repeated and coating deterioration reported after each complete cycle.

If coating is still satisfactory after 20 cycles, wipe lightly with a soft cloth and fresh water, allow 48 hours to thoroughly dry and recoat the central upper third of one side of each panel, masking the portion from the edge to 1/2 inch inward, with one coat of the finish coating of the coating system (or primer and finish coat if appropriate). Allow one week dry time and complete immersion test with five additional test cycles. Inspect for compliance with 3.9.

4.3.1.7 Service test. - A coating system having met all requirements of this specification with the exception of 3.10 and 3.11 shall be service tested by patch or complete tank or bulkhead application (in accordance with the supplier's instruction and to all extent possible to his satisfaction) on one or more suitable shipboard tanks for a minimum period of 18 months. At the end of the test period the coated area shall be examined for compliance with 3.10.

4.3.1.8 Resistance to boiling water. - A panel prepared in accordance with 4.3.1.6 shall be immersed to 6 inches of the 12 inch length in boiling distilled water in a suitable beaker for 500 hours or to prior failure. The extent, nature and time of failure shall be reported.

4.3.1.9 Resistance to fuel and water at 90°F. - A panel prepared in accordance with 4.3.1.6 except for size, approximately 2-1/2 x 5 inches, shall be immersed in 2 inches of 3 percent salt solution covered by 2 inches of the synthetic fuel of 4.3.1.6 in a Mason jar closed and sealed. The jar shall be kept at 90°F  $\pm$  5°F. by partial immersion in a water bath or other suitable means for 240 hours. The panel shall be removed and immediately examined and reported for any change in appearance, film failure or loss of apparent hardness and adhesion of the coating by visual observation and knife test.

4.3.1.10 Recoatibility. - Recoatibility for qualification of product shall be determined by 3.9 and 4.3.1.6. For identification characteristics in connection with acceptance of individual lots, after 24 hours dry time, the panel of 4.3.1.9 shall be recoated on one side with the finish coat of the coating system, (or primer and finish coat if appropriate) allowed 72 hours dry time and then be immersed in the same media of 4.3.1.9 for 24 hours, examined and reported as in 4.3.1.9.

4.3.1.11 Adhesion. - A separate panel similar to the panel tested under 4.3.1.10 shall be prepared at the same time. Adhesion of each coat shall be tested by knife just prior to application of the next coat and of the coating system just prior to the time of immersion of the 4.3.1.10 panel. After the immersion periods for the 4.3.1.10 panel, the adhesion between the immersed and the retained panel shall be compared.

4.3.1.12 Adhesion to aged vinylidene resin lacquer film, type II only. - A panel for test shall be prepared in accordance with 4.3.1.6, using five coats of lacquer conforming to MIL-L-18389, applied to a minimum total dry film thickness of 6 mils. The lacquer shall be laid on in full wet coats with a brush, taking care not to brush unnecessarily so as to minimize the incorporation of air bubbles. Alternate color coats shall be used. The panel shall be tested in accordance with 4.3.1.6 except at the end of the 20 cycle period, the coating system under test shall be applied to one complete side of the panel and reimmersed for five more cycles. After completion of the test, any film failures and the adhesion of the coating system to the lacquer shall be noted. In 4.3.1.7 a test in a tank coated with the lacquer system at least three years old shall be included.



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4.3.1.12.1 For identity and quality conformance inspection, procedure 4.3.1.9 shall be used except one coat of the white lacquer shall be applied and allowed 24 hours to dry prior to applying the coating system under test.

4.3.1.13 Tests for aviation fuel compatibility. - The effect of coating system on fuel degradation shall be measured by comparison of test results obtained on fuel in contact with the coating system with the same age unexposed fuel. Results of tests shall be forwarded to Code 633P, Bureau of Ships, Washington 25, D. C. The format shown in 6.5 is suggested for use in reporting test results.

4.3.1.13.1 Preparation of fuel samples for test. -

- (a) Apply coating system to four steel rods 3/4 inch x 7-1/2 inches drilled, threaded and fitted with a 1/8 inch x 3/4 inch all thread bolt for suspension. Allow 7 days drying time at ambient laboratory temperature after application of last coat prior to immersion in fuel.
- (b) Prepare approximately five liters each of particle free aviation gas and JP-5 fuels by repeated filtration through a type AA millipore filter as specified in paragraphs 7(a) and 7(b) of Appendix X - ASTM Standards Committee D-2 dated October 1960 using 115 145 aviation gas conforming to MIL-G-5572 and JP-5 fuel conforming to MIL-J-5624.
- (c) Wash coated test rods thoroughly with hot water at 180°F. ± 10°F. for 15 to 30 minutes, drain and dry. Mount test rod on a 1/4 inch x 7 inches square plastic beaker cover (for 2 liter beaker), center drilled for mounting test rod.
- (d) Into four clean 2-liter beakers, pour 1000-1200 mls (ml) of particle free aviation gas. Into four clean 2-liter beakers, pour 1000-1200 ml of particle free JP-5 fuel. Cover two beakers of each fuel with rod-mounted cover (for "exposed fuel" samples). Cover two beakers of each fuel with 1/4 inch x 7 inches square plastic beaker covers, plain (for "unexposed fuel" samples). Store all beakers with fuel in dark and maintain at 80° F. ± 10° F. for 30 days. Swirl fuel by rotating beakers at least three times daily.
- (e) On the 31st exposure day, test "exposed" and "unexposed" aviation gas and JP-5 fuel for color, corrosion, existent gum, and solids, and "exposed" and "unexposed" aviation gas for bromine in accordance with following test procedures.

4.3.1.13.2 Color. - Color for JP-5 fuel shall be determined in accordance with ASTM method D-156. Report difference between "exposed" and "unexposed" fuels. Colors of "exposed" and "unexposed" aviation gas shall be compared visually. Report difference as "pass" or "fail" in accordance with 3.16.1.

4.3.1.13.3 Corrosion. - Corrosiveness of both "exposed" and "unexposed" fuels shall be determined in accordance with ASTM method D-130.

4.3.1.13.4 Existent Gum. - Existent gum (both "washed" and "unwashed") shall be determined in accordance with ASTM method D-381. Report differences between "exposed" and "unexposed" fuels.

4.3.1.13.5 Solids (total sediment). - Solids shall be determined in accordance with Appendix X of ASTM Standards on Petroleum Products, Committee D-2, 37th Edition, 1960.

4.3.1.13.6 Bromine. - Bromine shall be determined on both the "exposed" and "unexposed" fuels in accordance with the following procedure:

4.3.1.13.6.1 Apparatus. - The apparatus used for the decomposition of bromides by sodium in liquid ammonia shall be as depicted in fig. 1. The center neck of the 250-ml, 2-neck, round bottom flask carries a teflon-sealed corrosion resistant steel stirring assembly. The side neck shall be fitted with a 2-hole rubber stopper through which pass an ammonia delivery tube and a vent protected by a drying tube containing drierite. After charging of the flask with liquid ammonia, the pictured rubber stopper shall be replaced with a 1-hole stopper fitted with a vent tube also protected by a drying tube.

The apparatus used for following the titration of bromides shall be a continuous indicating pH meter such as the Beckman Model M-2 equipped with a glass electrode and a silver electrode (note 1). A titration set-up shall be used, such as shown on fig. 2, which shall be capable of accurate delivery of stop-dro quantities of silver nitrate.

4.3.1.13.6.2 Materials and reagents. - The following materials and reagents shall be required:

dry ice and acetone for cooling  
 Drierite  
 ammonia  
 sodium  
 alcohol  
 sodium hydroxide pellets  
 ammonium persulfate  
 sodium arsenite (10%)  
 nitric acid, approx. 20%  
 silver nitrate, 0.05N.

4.3.1.13.6.3 Procedure for the analyses of gasolines. - The procedure for the analyses of decomposition of bromides shall be as follows:

- (a) Cool the flask with a dry-ice acetone slurry and introduce about 15 g of ammonia (see note 2). Replace the rubber stopper carrying the delivery tube by the one fitted only with a protected vent and add a cube of freshly cut sodium having an edge dimension of about 0.5 cm. Rotate the stirrer slowly by hand to partially dissolve the metal. Add exactly 50 ml of the gasoline under test (notes 3 and 4), remove the cooling bath, and start the stirrer. As soon as the ammonia starts to evolve, disconnect the drying tube from the vent (note 5). Continue the stirring until the ammonia has evaporated (about 20 min for a 15-g charge). If the characteristic blue color of sodium in liquid ammonia should disappear during the earlier stages of the evaporation, add another piece of sodium.

(b) Extraction and work-up of extract. -

Upon evaporation of the ammonia, add 5 ml of alcohol to the mixture to decompose the excess sodium. Next, add 30 ml of water and stir to aid extraction of the inorganic salts. Remove the reaction flask from the stirrer, washing down the stirrer with water, and transfer the contents to a separatory funnel. Separate the aqueous layer and extract the organic layer with two additional 30-ml portions of water. Combine the three aqueous extracts, evaporate to about 50 ml, and cool slightly. If, at this point, the mixture is not clear and contains a precipitate, filter and wash the paper with several small portions of hot water. Evaporate the combined filtrate and washings to about 50 ml and cool slightly. Add 2 g of sodium hydroxide pellets followed by 2 g of ammonium persulfate. After the solids have dissolved, boil the solution for about 15 minutes (notes 6 and 7). Cool the solution slightly, add 10 ml of a 10% solution of sodium arsenite, boil for 10 minutes, and then cool to room temperature. Make the solution acid to phenolphthalein by adding  $\text{HNO}_3$  (20%) and determine the bromides as given below (note 8).

(c) Titration of bromides. -

Immerse the titration electrodes into the solution, start the stirrer, and set the pH meter to read on the acid scale. If the pH meter shows an apparent pH reading of greater than 1.5, add more  $\text{HNO}_3$  until a reading of 0 to 1.5 is obtained. Next, titrate the bromides with 0.05N  $\text{AgNO}_3$ , making a record of apparent pH versus ml  $\text{AgNO}_3$  added. From a plot of the data, determine the appropriate inflection points and calculate the quantities of bromides present by the formulae given below.

$$\text{g Br} = 0.003996\text{B}$$

or

$$\text{g Br/gal at } 60^\circ\text{F} = 0.3025\text{B} [1 + 0.00065(t - 60)],$$

where

B = ml 0.05N  $\text{AgNO}_3$  required to titrate bromide, and

t = temperature ( $^\circ\text{F}$ ) of gasoline when sampled.

NOTES:

1. A heavy-gage silver wire attached directly to the calomel jack of the pH meter may be used. The portion that dips into the liquid should be cleaned by rubbing lightly with fine emery paper and rinsing with distilled water.
2. It is convenient to use a lecture bottle as the source of ammonia. From such a container, the gaseous ammonia may be introduced into the flask with virtually complete condensation at rates up to 2 g. min. The quantity of ammonia being added can be followed by periodic weighing of the lecture bottle. All steps involving the charging and evaporation of ammonia should be carried out in a hood.
3. In general, it may be advisable to precool the sample by placing it in a flask surrounded by dry ice prior to introducing it into the sodium liquid ammonia mixture. In such cases, care should be taken to protect the sample from moisture and from dissolving carbon dioxide. After adding a precooled sample to the reaction mixture, the cooling vessel may be rinsed with about 10 ml of isooctane (at room temperature) and this rinsing may be added directly to the reaction mixture.
4. By using a slightly larger amount of ammonia (about 20 g), it has been found that precooling is not necessary. Under these conditions, a 50-ml sample of gasoline (at room temperature) may be added directly into the reaction mixture without causing excessive boiling of the ammonia, provided that the addition is as slow as from a pipet.
5. If indicating Drierite is used, evolution of ammonia is evidenced by a color change.
6. During this period it is important that the solution remain alkaline. Since sulfuric acid is one of the decomposition products of ammonium persulfate, the solution should be checked occasionally to assure alkalinity. This may be done using litmus paper as an external indicator or methyl orange as an internal indicator. In the majority of cases, the 2 g of sodium hydroxide specified will be entirely sufficient, however, should it be found that the solution is becoming acid, more sodium hydroxide should be used.
7. In some cases a reddish solid or a dark solution may form during the oxidation step. Such behavior will not affect the analyses.
8. At this point, the solution may contain a precipitate. This is of no consequence and usually will redissolve on further acidification in the next step.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing and marking. - Unless otherwise specified in the contract or order, the coating of the coating system for Class 3 shall be delivered in 1-gallon cans or 5-gallon pails. Classes 1, 2 and 4 shall be delivered in 1 or 5-gallon amounts in suitable unitized packaging. Coating of the coating system shall be packaged level A or C; packed level A, B or C, as specified (see 6.2) and marked in accordance with TT-P-143.

5.2 Marking. - In addition to any special marking specified in the contract or order, each container shall have affixed a warning label of appropriate size similar to class 1 or class 2 of MIL-L-19868 as appropriate or warning labels shall be lithographed or stencilled with a reasonable likeness thereof. Under "contains" shall be inserted the solvents (flash point) and other ingredients considered toxic such as leaded pigments contained therein. Where conflict with ICC regulation may exist on containers not overpacked, modification of the label design to smaller size or a printed statement of the solvents with flash point and toxics will be satisfactory.

6. NOTES

6.1 Although the different classes of coating systems of this specification afford superior protection for various shipboard tanks, the coating systems are not necessarily interchangeable or of equal merit for all types of tanks and conditions of application. None of the coating systems covered herein are suitable for use in fresh or potable water tanks except by conformance to additional requirements. Class 2 coating systems may discolor fuel in clean fuel tank service. Class 3 coating systems may be unsuitable for acidic or alkaline cargoes. The coating systems vary to some extent in surface preparation required and

effect of high humidity, slight surface moisture and temperature during application. Many factors involve the total overall cost per square foot per year for tank application, possibly the least of which is the cost of the coating systems which average about 10 percent of the total cost. The number of coats per coating system and square foot coverage per gallon further complicate the equity of purchase solely on the basis of lowest cost per gallon. Procurement officers therefore should fully consider such factors.

**5.2 Ordering data.** - Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type and class required (see 1.2 and 6.1)
- (c) Size of container.
- (d) Level of packaging and packing required (see 5.1).
- (e) Special marking required (see 5.2).

6.3 With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List QPL 23236, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Bureau of Ships, Department of the Navy, Washington 25, D. C., and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3.1).

6.3.1 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania.

6.4 This specification is the result of 19 years of laboratory evaluation, service test and fleet use of suitable materials. Although the requirements appear to be quite stringent, they represent a bare minimum and quite possibly an insufficient basis to obtain coatings that provide the 8 to 10 years protection desired. Since long term durability data is not yet available (over 3 years performance), tank performance records will be maintained. This data will be used for future revisions of this specification as necessary and may require reevaluation of qualified product approval granted under existing requirements.

6.5 The following format is suggested for reporting test results required by 4.3.1.13.2 to 4.3.1.13.6 inclusive:

Filtered JP-5 Fuel (MIL-J-5624)

	Saybolt Color	Corrosion	Existent Unwashed	Gum Washed	Solids
(a) Exposed Fuel					
(b) Unexposed Fuel					
(c) Difference					
(d) Requirements	2 (max.)	None	4 mg/100ml (max.)	2 mg/100ml (max.)	2 mg/liter (max.)

Filtered 115/145 Aviation Gas (MIL-G-5572)

	Color	Corrosion	Existent Unwashed	Gum Washed	Solids	Bromine
(a) Exposed Fuel						
(b) Unexposed Fuel						
(c) Difference						
(d) Requirements	To Pass	None	4 mg/100 ml. (max.)	2 mg/100 ml. (max.)	2 mg/100 ml. (max.)	10% (max.)

Test Report No. \_\_\_\_\_

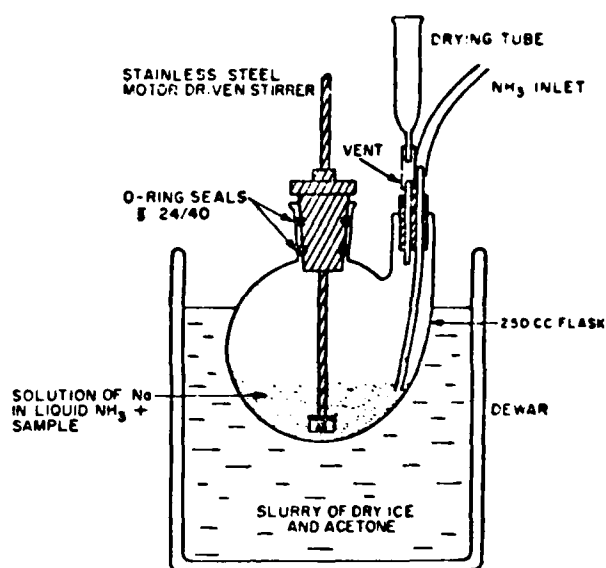
Name and Location of Testing Lab. \_\_\_\_\_

Date of Report \_\_\_\_\_

MIL-P-23236(SHIPS)

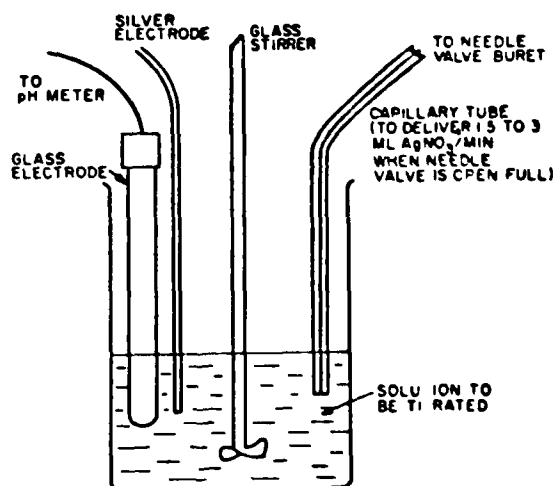
Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Preparing activity:  
Navy - Ships  
(Project 8030-N037Sh)



Sh 7092

Figure 1 - Apparatus for the decomposition of organic halides



Sh 7093

Figure 2 - Potentiometric titration assembly

MIL-P-23236(SHIPS)  
AMENDMENT - 4  
17 December 1965  
SUPERSEDING ✓  
AMENDMENT - 3  
27 July 1965

MILITARY SPECIFICATION  
PAINT COATING SYSTEMS, STEEL SHIP TANK  
FUEL AND SALT WATER BALLAST

This amendment forms a part of MIL-P-23236(SHIPS), dated 28 June 1962.

Page 1, paragraph 1.2.1, Class 2: Delete and substitute:

"Class 2 - Coal tar - Epoxy (not permitted for aviation fuel tanks)."

Page 4, Table I, Note 6, line 2: Delete "No. 32" and substitute "No. 325".

Page 5, paragraph 4.1: Delete and substitute:

"4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements."

Page 5, paragraph 4.3.1.1: Delete and substitute:

"4.3.1.1 Qualification tests. - Qualification tests shall consist of all tests specified in this specification. All tests other than those for compliance with requirements of 3.9 (see 4.3.1.6), 3.10 and 3.11 (see 4.3.1.7) shall be made by the supplier. After satisfactory completion of tests, the supplier shall submit the results of the tests with actual values showing compliance with 3.2 through 3.8 with a request for the immersion test specified in 4.3.1.6 and with a request for the service test specified in 4.3.1.7."

↓  
CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THIS DOCUMENT HAVE BEEN MARKED "#" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

FSC 8030

MIL-P-23236(SHIPS)  
AMENDMENT - 4

Sufficient material to apply a complete coating system over an area up to 5,000 square feet will be required. The service test will be conducted on a Naval ship or as an alternate, consideration will be given to commercial applications recommended by the supplier and deemed equivalent by the Bureau of Ships. The immersion test will be conducted by the Mare Island Division, San Francisco Bay Naval Shipyard Paint Laboratory, Vallejo, California. The laboratory must be provided sufficient material for this purpose. Performance after 18 months service shall be evaluated by technical personnel as designated by the Bureau of Ships."

Page 6, paragraph 4.3.1.4, Applicable method, line 1: Delete "4058" and substitute "4053".

Page 12, Notice: Delete.

Preparing activity:  
Navy - SH  
(Project 8030- NO51Sh)

Page 2  
of 2 pages



QUALIFICATIONS VALIDATED  
APRIL 1977

QPL-23236-40  
8 April 1977  
SUPERSEDING  
QPL-23236-39  
8 September 1976

QUALIFIED PRODUCTS LIST  
OF  
PRODUCTS QUALIFIED UNDER MILITARY SPECIFICATION  
MIL-P-23236  
PAINT COATING SYSTEMS, STEEL SHIP TANK  
FUEL AND SALT WATER BALLAST

FSC 8030

This list has been prepared for use by or for the Government in the procurement of products covered by the subject specification and such listing of a product is not intended to and does not connote indorsement of the product by the Department of Defense. All products listed herein have been qualified under the requirements for the product as specified in the latest effective issue of the applicable specification. This list is subject to change without notice; revision or amendment of this list will be issued as necessary. The listing of a product does not release the supplier from compliance with the specification requirements.

THE ACTIVITY RESPONSIBLE FOR THIS QUALIFIED PRODUCTS LIST IS THE NAVAL SHIP ENGINEERING CENTER.

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 1	Amercoat Primer No. 81 Amercoat Topcoat No. 82	8 (min)	BUSHIPS 23236-59	Ameron Protective Coatings Div. 201 N. Berry St. Brea, CA 92621 Plants: 201 N. Berry St. Brea, CA 92621 111 Colgate Ave. Buffalo, NY 14220
Type I Class 1	Carboline 187 HFP Primer Carboline 187 HFP Finish	8 (min)	NAVSEC 23236-75	Carboline Co. 350 Hanley Industrial Court St. Louis, MO 63144 Plants: W Ankeney Mill Rd. Xenia, OH 45385 900 Opelousa Lake Charles, LA 70701 24353 Clawiter Rd. Hayward, CA 94545
Type I Class 1	DEVTRAN 215 System (Tank Primer Formula 202A, Tank Coating Formula 215)	8 (min)	BUSHIPS 23236-14	Devco & Reynolds Co., Inc. A Grow Chemical Subsidiary 4000 DuPont Circle Louisville, KY 40207 Plant: 2625 Durahart St. Riverside, CA 92502

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 1	DEVTRAN 244 HS	8 (min)	NAVSEC 23236-124	Devco & Reynolds Co., Inc. A Grow Chemical Subsidiary 4000 DuPont Circle Louisville, KY 40207 Plant: 2625 Durahart St. Riverside, CA 92502
Type I Class 1	RUST-BAN EM 6664 (HF)/ RUST-BAN EX 6671 (HF)	8 (min)	NAVSEC 23236-82	Exxon Chemical Co. U.S.A. RUST-BAN Coatings Division P. O. Box 3272 Houston, TX 77001 Plant: 8230 Stedman St. Houston, TX
Type I Class 1	Farbo-Coat #99 System (Primer #99PR, red, Top Coat #99E, white)	10 (min)	NAVSEC 23236-58	Farboil Company 8200 Fischer Road Baltimore, MD 21222 Plant: Same address
Type I Class 1	Primastic P-16-57 4000 Series Topcoat	12 (min)	NAVSEC 23236-104	Grow Chemical Coatings Corp. Prufcoat Division 453 Springfield Rd. Baton Rouge, LA 70807 Plant: Same address
Type I Class 1	Intergard Tank Coating Systems 4400/4423 Series and 4400/4423/4479 (40°F) Series	8 (min)	BUSHIPS 23236-67	International Paint Co. (Calif) Inc. 220 S. Linden Ave. S. San Francisco, CA 94080 Plants: 220 S. Linden Ave. S. San Francisco, CA Morris & Elmwood Aves. Union, NJ 3915 Louisa St. New Orleans, LA
Type I Class 1	2 coat SOVAPON Hi Build System: (Use any two) 264-F-25 (Gray)/ 264-W-12 (White), 264-R-101 (Red) 264-G-102 (Pastel Green) 264-F-102 (Haze Gray)	8 (min)	BUSHIPS 23236-42	Mobil Chemical Co. Maintenance & Marine Coatings Div. P. O. Box 250 Edison, NJ 08817 Plants: Lincoln Hwy. Edison, NJ 08817 1004 W. 10th St. Azusa, CA 91702 1700 S. Juliette St. Beaumont, TX 77701
Type I Class 1	SOVAPON 264-W-101 White/ 264-F-101 Gray and 264-D-107 Buff/ 264-R-110 Red	8 (min)	NAVSEC 23236-152	Mobil Chemical Co. Maintenance & Marine Coatings Div. P.O. Box 250 Edison, NJ 08817 Plant: Lincoln Hwy. Edison, NJ 08817

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 1	Varni-Lite 1000 Series 3 cote system (Prime cote Orange, White & Tan)	8 (min)	BUSHIPS 23236-56	Varni-Lite Corp. of America 3005 Copper Road Santa Clara, CA 95051 Plant: Same address
Type I Class 2 (except for use in avia- tion fuel tanks)	Amercoat No. 78 Black & Red	16 (min)	BUSHIPS 23236-39	Ameron Protective Coatings Div. 201 N. Berry St. Brea, CA 92621 Plants: 201 N. Berry St. Brea, CA 92621 111 Colgate Ave. Buffalo, NY 14220
Type I Class 2 (except for use in avia- tion fuel tanks)	Carbomastic 16 HFP	16 (min)	NAVSEC 23236-76	Carboline Company 350 Hanley Industrial Court St. Louis, MO 63144 Plants: W Ankeney Mill Rd. Xenia, OH 45385 900 Opelousa Lake Charles, LA 70701 24353 Clawiter Rd. Hayward, CA 94545
Type I Class 2 (except for use in avia- tion fuel tanks)	TAREP 401 Black	16 (min)	BUSHIPS 23236-11	Corro-Ban Products Co. A Grow Chemical Subsidiary 18414 S. Santa Fe Ave. P. O. Box 190 Long Beach, CA 90801 Plants: 18414 S. Santa Fe Ave. Long Beach, CA 90801 1010-26 N. 19th St. Tampa, FL 33622 453 Springfield Rd. Baton Rouge, LA 70807 1246 W. 70th St. Cleveland, OH 44102
Type I Class 2 (except for use in avia- tion fuel tanks)	TAREP 940 Red	16 (min)	BUSHIPS 23236-17	Corro-Ban Products Co. A Grow Chemical Subsidiary 18414 S. Santa Fe Ave. P. O. Box 190 Long Beach, CA 90801 Plants: 18414 S. Santa Fe Ave. Long Beach, CA 90801 1010-26 N. 19th St. Tampa, FL 33622 453 Springfield Rd. Baton Rouge, LA 70807 1246 W. 70th St. Cleveland, OH 44102

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 2 (except for use in aviation fuel tanks)	Bitumastic No. 300-M	10 (min)	BUSHIPS 23236-21	Koppers Co., Inc. Koppers Bldg. Pittsburgh, PA 15219 Plant: 449 South Ave. Westfield, NJ
Type I Class 2 (except for use in aviation fuel tanks)	NAPKO 5635	16 (min)	NAVSEC Test 23236-147	Napko Corporation P.O. Box 14509 Houston, TX 77021 Plant: 5300 Sunrise St. Houston, TX
Type I Class 2 (except for use in aviation fuel tanks)	TARSET STANDARD	15 (min)	BUSHIPS 23236-1	Porter Paint Co. P. O. Box 1439 Louisville, KY 40201 Plant: 1301 W. Kentucky St. Louisville, KY
Type I Class 2 (except for use in aviation fuel tanks)	TARSET STANDARD/ TARSET RED	15 (min)	BUSHIPS 23236-46	Porter Paint Co. P. O. Box 1439 Louisville, KY 40201 Plant: 1301 W. Kentucky St. Louisville, KY
Type I Class 3	DIMETCOTE No. 3	2-3	BUSHIPS 23236-2	Ameron Protective Coatings Div. 201 N. Berry St. Brea, CA 92621 Plants: 201 N. Berry St. Brea, CA 92621 111 Colgate Ave. Buffalo, NY 14220
Type I Class 3	DIMETCOTE No. 4	3-5	BUSHIPS 23236-2	Ameron Protective Coatings Div. 201 N. Berry St. Brea, CA 92621 Plants: 201 N. Berry St. Brea, CA 92621 111 Colgate Ave. Buffalo, NY 14220
Type I Class 3	P-1500 Inorganic Zinc Primer	3-5	NAVSEC 23236-85	Andrew Brown of Koppers Co., Inc. Koppers Building Pittsburgh, PA 15219 Plants: 5431 District Blvd. Los Angeles, CA Marietta, GA Irving, TX 480 Frelinghuysen Ave. Newark, NJ

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 3	BioZinc 103	3-4	NAVSEC 23236-66	Banner Paint Div. Rockford Chemical Coatings, Inc. 1825 Avenue H St. Louis, MO 63125 Plant: Same address
Type I Class 3	Carbo Zinc 11 HFP, Gray or Green	3-4	BUSHIPS 23236-13	Carboline Co. 350 Hanley Industrial Court St. Louis, MO 63144 Plants: W Ankeney Mill Rd. Xenia, OH 45385 900 Opelousa Lake Charles, LA 70701 24353 Clawiter Rd. Hayward, CA 94545
Type I Class 3	Galva-Pac #200	3-4	NAVSEC Test 23236-86	Cook Paint & Varnish Co. P. O. Box 389 Kansas City, MO 64141 Plants: Kansas City, MO 64141 Houston, TX Milpitas, CA 95035
Type I Class 3	Cathacoat 300: MD 1588 Liquid Portion MD 1856 Powder Portion MD 2599 Curing Solution (blue)	2-4	BUSHIPS 23236-3	Devoe & Reynolds Co., Inc. A Grow Chemical Subsidiary 4000 DuPont Circle Louisville, KY 40207 Plant: 2625 Durahart St. Riverside, CA 92502
Type I Class 3	Catha-Coat 305	3-5	NAVSEC 23236-118	Devoe & Reynolds Co., Inc. A Grow Chemical Subsidiary 4000 DuPont Circle Louisville, KY 40207 Plant: 2625 Durahart St. Riverside, CA 92502
Type I Class 3	Engard 511	3-4	NAVSEC Test 23236-86	Engard Coatings Corp. 15541 Commerce Lane Huntington Beach, CA 92649 Plant: Same address
Type I Class 3	10-12-75 Inorganic Zinc Rich Coating	3-4	NAVSEC Test 23236-86	Everseal Mfg. Co., Inc. 475 Broad Ave. Ridgefield, NJ 07657 Plant: Same address
Type I Class 3	RUST-BAN 191	3-5	BUSHIPS 23236-18	Exxon Chemical Co. U.S.A. RUST-BAN Coatings Div. P. O. Box 3272 Houston, TX 77001 Plant: 8230 Stedman St. Houston, TX

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 3	RUST-BAN 191/195	2-4	BUSHIPS 23236-18	Exxon Chemical Co. U.S.A. RUST-BAN Coatings Div. P. O. Box 3272 Houston, TX 77001 Plant: 6230 Stedman St. Houston, TX
Type I Class 3	Farbozinc #76 Liquid Portion Powder Portion Curing solution Farbozinc #76 Liquid Portion Powder Portion	3-4	NAVSEC 23236-105	Farbco Company 6200 Fischer Road Baltimore, MD 21222 Plant: Same address
Type I Class 3	Zincprime 200	3-4	NAVSEC 23236-90	Grow Chemical Coatings Corporation Prufcoat Division 453 Springfield Rd. Baton Rouge, LA 70807 Plant: Same address
Type I Class 3	ZINCILATE 101-C	3-5	BUSHIPS 23236-12	Industrial Metal Protectives Inc. 821B Boone Ave. Florence, KY 41042 Plant: W. Ankney Mill Rd. Xenia, OH 45385
Type I Class 3	TANCLENE SILICATE 2440/2441	3-4	NAVSEC Test 23236-86	International Paint Co., Inc. 17 Battery Place North New York, NY 10004 Plants: 220 S. Linden Ave. S. San Francisco, CA Morris & Elmwood Aves. Union, NJ 3915 Louisa St. New Orleans, LA
Type I Class 3	Mobilzinc 1	3-4	NAVSEC 23236-53	Mobil Chemical Co. Maintenance & Marine Coatings Division P.O. Box 250 Edison, NJ 08817 Plants: Lincoln Highway Edison, NJ 08817 1004 W. 10th St. Arusa, CA 91702 901 Greenwood Ave. Kankakee, IL 60901 1700 Doucette St. Beaumont, TX 77701

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 3	Mobilzinc 7 High Flash	3-4	NAVSEC 23236-101	Mobil Chemical Co. Marine & Maintenance Coatings Div. P.O. Box 250 Edison, NJ 08817 Plants: Lincoln Hwy. Edison, NJ 08817 1004 W. 10th St. Azusa, CA 91702 901 Greenwood Ave. Rankakee, IL 60901 1700 Doucette St. Beaumont, TX 77701
Type I Class 3	NAPKO 42 (Self-cured)	3-4	BUSHIPS 23236-36	Napko Corporation P.O. Box 14509 Houston, TX 77021 Plants: 5300 Sunrise St. Houston, TX 40600 Albrae Ave. Fremont, CA
	Napko 42 (Post-Cured)	3-4	NAVSEC 23236-129	
Type I Class 3	METALHIDE 100	3-4	BUSHIPS 23236-49	PPG Industries, Inc. General Offices Coatings & Resins Div. One Gateway Center Pittsburgh, PA 15222 Plant: 6621 Liberty Rd. Houston, TX
Type I Class 3	Quram 3365 W2	3-4	NAVSEC Test 23236-86	Philadelphia Quartz Co. P. O. Box 840 Valley Forge, PA 19482 Plant: Foot of Lamokin St. Chester, PA
Type I Class 3	Zincguard No. 4	3-4	NAVSEC Test 23236-136	Seaguard Corp. P. O. Box 669 Portsmouth, VA 23705 Plant: 4030 Seaguard Ave. Portsmouth, VA
Type I Class 3	Zinc Clad 8 B69 A48	3-5	BUSHIPS 23236-18	The Sherwin-Williams Co. 101 Prospect Ave., N.W. Cleveland, OH 44101 (Distributor) Exxon Chemical Co. U.S.A. Houston Chemical Plant 8230 Stedman St. Houston, TX 77029 (Manufacturer)

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TOTAL DRY FILM THICKNESS (mils)	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Type I Class 4	Devron 215W System Tank Primer Formula 202A Tank Coating Formula 215W	8 (min)	NAVSEC 23236-114	Devco & Reynolds Co., Inc. A Grow Chemical Subsidiary 4000 DuPont Circle Louisville, KY 40207 Plant: 2625 Durahart St. Riverside, CA 92502
Type I Class 4	Laminar X-500 (System) Primer 4-G-14-4 Finish 4-W-1-4 or 4-X-41-4	6 (min)	NAVSEC 23236-62	Dexter Corp. Midland Division 31500 Hayman St. Hayward, CA 94544 Plant: Same address
Type I Class 4	PR-1120 Orange/ PR-1120 White	6 (min)	NAVSEC 23236-154	Products Research & Chemical Corp. 2919 Empire Ave. Burbank, CA 91505 Plant: 5454 San Fernando Rd. Glendale, CA 91203

NOTE: As of 8 April 1977, no Type II Paint Coating System has been tested and qualified under Specification MIL-P-23236(Ships). Pending the inclusion of this type on the Qualified Products List, the qualification requirements (Paragraphs 3.1 and 6.3) of Specification MIL-P-23236(Ships) shall be waived for procurement of Type II; however, procuring agencies should require first article inspection invoking tests of paragraph 4.3.1.1 of MIL-P-23236(Ships). A copy of the first article test data, as certified to by the responsible government inspector, shall be forwarded to the applicable qualifying activity.



4 OCT 1977

DOD-P-21035A (NAVY)  
21 November 1977  
SUPERSEDED  
MIL-P-21035 (SHIPS)  
23 August 1957  
(See 6.6)

METRIC

#### MILITARY SPECIFICATION

#### PAINT, HIGH ZINC DUST CONTENT, GALVANIZING REPAIR (METRIC)

This specification is approved for use by all interested Commands of the Department of the Navy and the Marine Corps and is available for use by all other Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers a high zinc dust content paint for reglvanizing welds in galvanized steels.

#### 2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

#### SPECIFICATIONS

##### FEDERAL

RR-S-366 - Sieve, Test.  
TT-P-460 - Pigment, Zinc-Dust (Metallic-Zinc-Powder) Dry.  
PPP-P-1892 - Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing, and Marking of.

##### MILITARY

MIL-S-16113 - Steel Plate, High Tensile(HT), Hull and Structural.

#### STANDARDS

##### FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing.  
FED-STD-313 - Material Safety Data Sheets, Preparation and the Submission of.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 93 - Flash Point by Pensky-Martens Closed Tester, Test for.  
D 521 - Zinc Dust (Metallic Zinc Powder), Chemical Analysis of.  
D 562 - Consistency of Paints Using the Stormer Viscosimeter, Test for.  
D 1475 - Density of Paint, Varnish, Lacquer, and Related Products, Test for.  
D 2369 - Volatile Content of Paints, Test for.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Ship Engineering Center, SEC 6124, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8010

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

### 3. REQUIREMENTS

**3.1 Toxicity.** The material shall have no adverse effect on the health of personnel when used for its intended purpose (see 4.6). Questions pertinent to this effect shall be referred by the procuring activity to the appropriate service medical department which will act as advisor to the procuring activity.

**3.2 Materials.** The paint shall consist of zinc dust conforming to type I of TT-P-460, either ready-mixed or in a two-compartment container with resins, oils, and solvents properly processed to conform with all requirements as herein specified.

**3.3 Manufacture.** When the paint is supplied as a ready-mixed, single-package product, the component raw materials shall be mixed and ground as required to produce a product which is uniform, free from dirt and grit, entirely suitable for the purpose intended, and in full conformity with the requirements of this specification.

**3.4 Quantitative requirements.** Quantitative requirements shall be as shown in table I and as herein specified. Test reports required by method 1031 of FED-STD-141 shall include the exact formula used.

TABLE I. Quantitative requirements.

Characteristic	Minimum	Maximum
Pigment, percent of weight of nonvolatile content	94.0	---
Pigment, percent zinc by analysis	97.5	---
Pigment, kg (pounds) per gallon of paint	5.455 (12.0)	---
Flash point, °C (°F)	38 (100)	---
Drying time - set-to-touch, hours	0.5	2
dry hard, hours	---	8

**3.4.1 Solvent.** The solvent portion of the paint shall conform to requirements herein specified.

- (a) A combination of hydrocarbons, alcohols, aldehydes, ethers, esters, or ketones having an olefinic or cycloolefinic type of unsaturation except perchloroethylene: 5 percent maximum.
- (b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene, methyl benzoate, and phenyl acetate: 8 percent maximum.
- (c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene, or toluene: 20 percent maximum.

**3.5 Qualitative requirements.** The paint shall comply with the qualitative requirements specified herein.

**3.5.1 Condition in container.** The mixed paint or the vehicle portion, if supplied as a two-compartment package, shall be capable of being broken up to a smooth, uniform consistency. It shall not increase more than 15 Krebs units in viscosity or increase more than 2 hours in drying time. It shall not liver, curdle, gel, or show any other objectionable properties for at least 1 year after date of manufacture, when tested as specified (see 4.4).

**3.5.2 Application characteristics.** The mixed paint, when tested as specified (see 4.4.4), shall be capable of being brushed out without excess drag on the brush. When dry, the brush-coated surface shall be free from sags, runs, wrinkles, excess brush marks, or other film defects. The film shall exhibit good adhesion and a smooth, uniform appearance.

3.5.3 Salt spray resistance. The uncoated area of the test panel shall not be completely rusted. The coated area shall show less than 5 percent rust. There shall be no blistering, loss of adhesion, or other film failure, except pinpoint rusting and white corrosion product, when tested as specified (see 4.4.3).

3.5.4 Knife test. A film of the mixed coating, when prepared and tested as specified (see 4.4.5), shall be tough and hard and shall adhere tightly to the metal panel. It shall be difficult to furrow off with the knife and shall not flake, chip, or powder. The knife cut shall show bevelled edges.

3.5.5 Stability in partially full container. When tested as specified (see 4.4.6), the vehicle reaction shall exhibit no evidence of skinning.

3.5.6 Material Safety Data Sheet. The procuring activity shall be provided a material safety data sheet (MSDS) at the time of contract award. The MSDS is DD form 1813 and found in and part of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality conformance inspection. Quality conformance inspection shall be provided in accordance with method 1031 of FED-STD-141 and as herein supplemented.

#### 4.3 Additional inspection.

4.3.1 Ingredient materials. When requested by the testing laboratory or other controlling authority, 1 pint of each ingredient used (see 3.4) shall be supplied for test purposes.

#### 4.4 Test procedures. Tests shall be conducted in accordance with table II.

TABLE II. Test procedures.

Tests <sup>1/</sup>	Applicable method of FED-STD-141	Applicable ASTM test method
Pigment content <sup>2/</sup>	4021	----
Nonvolatile content <sup>2/</sup>	----	D 2369
Application characteristics	2141	----
Condition in container	3011	----
Drying time	4061	----
Weight per gallon <sup>2/</sup>	----	D 1475
Viscosity, Krebs-Stormer	----	D 562
Flash point <sup>2/</sup>	----	D 93
Salt spray resistance	6061	----
Knife test	6304	----
Total zinc, percent of pigment <sup>2/</sup>	----	D 521
Stability in partially full container	3021	----

<sup>1/</sup> These tests shall be performed and reported even though they may not be specific requirements of this specification.

<sup>2/</sup> For ready-mixed paint, determine percent pigment, nonvolatile content, percent zinc, weight per gallon, and flash point. Calculate requirements of table I. For two-compartment packaged paint, the nonvolatile content and flash point on the vehicle portion and total zinc on the pigment portion may be determined without mixing the components, provided the pigment portion consists solely of dry pigment. The mixing instruction may be used in calculating the requirements of table I.

#### 4.4.1 Pigment analysis.

4.4.1.1 Pigment content. Extract the pigment from a weighed sample of the mixed paint as in method 4021 of FED-STD-141, using the appropriate extraction mixture. Dry and weigh the extracted pigment. Calculate the percent pigment in the paint.

4.4.1.2 Total zinc. Determine the total metallic zinc content in the extracted pigment or in the zinc dust pigment of the two-component product in accordance with ASTM D 521.

4.4.2 Drying time. Determine drying time by method 4061 of FED-STD-141, except that the specified conditions of temperature and humidity shall apply only for referee tests in case of dispute. All other tests shall be conducted under prevailing laboratory conditions.

4.4.3 Salt spray resistance. Determine salt spray resistance in accordance with method 6061 of FED-STD-141, except that three 10.6-centimeter (-cm) by 15.24-cm by 0.32-cm (4-by 6-by 1/8-inches) mild steel panels shall be used for this test. All surfaces shall be blasted with a medium grit (pass through 0.071-cm (710-micron) and retained on 0.042-cm (420-micron) sieve conforming to RR-S-366) prior to coating. A 1.27-cm (1/2-inch) wide strip shall be left uncoated along the longitudinal center of test face of each panel to observe degree of cathodic protection provided by the coating. Two coats of paint shall be brush applied uniformly to all remaining surfaces of each panel to a minimum thickness of 5.08 millimeter (mm) (2 mils). A drying time of 24 hours between coats and 48 hours for the second coat shall be observed. The panels shall be exposed in the salt spray apparatus for 288 hours, then evaluated for percent rust on the coated and uncoated areas. Rust streaking shall be disregarded in determining these percentages. The average of the three panels shall be determined for each area. Additionally, film failure of coated areas shall be noted and reported.

4.4.4 Application characteristics. Determine application characteristics of the mixed paint in accordance with method 2141 of FED-STD-141. The paint shall be applied to 30.48-cm (1-foot) squares of 0.64-cm (1/4-inch) galvanized steel plates conforming to MIL-S-16113. The film thickness of the dried paint shall be averaged from five measurements using a micrometer or other equivalent instrument. Check for compliance to 3.5.2.

4.4.5 Knife test. Solvent clean a steel panel of the type specified in method 2011 of FED-STD-141, using the petroleum naphtha-ethylene glycol monoethyl ether mixture. Draw down a 5.08-cm (2-inch) wide film of the mixed paint with a suitable film applicator designed to deposit a dry film thickness of 0.00229 cm to 0.00279 cm (0.0009 to 0.0011 inch). Allow the paint film to dry for 48 hours in a horizontal position at ambient laboratory conditions. Perform the knife test in accordance with method 6304 of FED-STD-141 and observe for compliance with 3.5.4.

4.4.6 Stability in partially filled container. Check by method 3021 of FED-STD-141 for compliance to 3.5.5.

4.5 Inspection of preparation for delivery. Inspect the packaging, packing, and marking of the material to determine compliance with the requirements of section 5 of this specification.

4.6 Toxicity. A manufacturer of material shall disclose the formulation of his product to the Navy Bureau of Medicine and Surgery, Navy Department, Washington, DC 20372. The disclosure of proprietary information, which shall be held in confidence by the Bureau of Medicine and Surgery, shall include: the name, formula, and approximate percentage by weight and volume of each ingredient in the product; the results of any toxicological testing of the product; identification of its pyrolysis products; and any such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use, or disposal of the material.

## 5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements.)

5.1 Packaging, packing, and marking. The paint shall be packaged, packed, and marked in accordance with PPP-P-1892. The level of packaging shall be A or C and level of packing shall be A, B, or C, as specified (see 6.2). The product shall be furnished in 1-gallon cans or 5-gallon pails of the mixed paint or in a two-compartment kit containing separate predetermined amounts of zinc dust and vehicle, as specified (see 6.2).

5.2 Special marking. In addition to the markings required by the contract or order (see 6.2), each container, interior and exterior, shall be marked with the following:

"The volatile content of the material in this container is not photochemically reactive as defined by Rule 102 of the South Coast Air Quality Management District." (See 6.4)

## 6. NOTES

6.1 Intended use. This specification covers paint intended for use for regalanizing welds in galvanized steels.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type of product required (ready-mixed or two-component) (see 3.2).
- (c) Level of packaging and level of packing required (see 5.1).
- (d) Size of container required (see 5.1).
- (e) Special marking required (see 5.1).

6.3 Unit of purchase. Paint should be purchased under this specification by volume, the unit being 1 U.S. gallon (231 cubic inches) at 15.5°C (60°F).

6.4 Packaging. Level B is intended to provide economical but limited protection. It should be specified only when it is determined that the paint will be held in covered storage no more than 1 year from date of initial packaging.

6.5 Volatile content. Although the container marking specifically refers to the South Coast Air Quality Management District, the paint may be used anywhere else a paint complying with 3.3.1 is allowed. This includes all other air pollution control districts or similar areas controlling the emission of solvents into the atmosphere. Information regarding Los Angeles County Air Pollution Rules 102, 442, and 443 may be obtained from: South Coast Air Quality Management District, Metropolitan Zone, 434 South San Pedro Street, Los Angeles, California 90013.

6.6 Changes from previous issue. The symbol "\*" is not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodian:

Navy - SH

Preparing activity

Navy - SH

(Project No. 8010-N110)

User activity:

Navy - EC, YD

U.S. GOVERNMENT PRINTING OFFICE: 1977-703-122/6991

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## II NASA'S ZINC-RICH COATING

### Technical Characteristics

NASA's potassium silicate/zinc-dust coating (TSP-70-10060) resists cracking, corrosion, and fire. It is self-curing and easy to apply. Its greatest asset, however, is its adherence capability, even under extreme conditions such as salt fog and thermal shock.

Zinc has a higher electromotive potential than iron or steel and, in the presence of an electrolyte such as saltwater, will be sacrificed to protect the steel. When zinc ions go into solution, they liberate electrons, which cause a current flow into the steel to prevent ferrous ions from going into solution and beginning the electrochemical corrosion process. To function anodically, the zinc particles must be in intimate contact with one another so that the coating film is electrically conductive. Contact is achieved by very high zinc loading with a relatively small amount of binder.

Potassium silicate is known to be an effective binder for zinc dust, provided the mole ratios of silica to potassium oxide are maintained at a high level. The mole ratios of currently available zinc-rich coatings generally peak at about 3.1:1; however, because of its unique binder formulation, the NASA coating boasts a range of 4.8:1 to 5.3:1.

The NASA coating contains 19 to 23 parts (percent solids in solution) by weight of potassium silicate, plus zinc dust (at 6 to 27 times the percent by weight silicate solids). To this basic mixture, methyltrimethoxysilane is added in amounts up to 3% by weight to act as a buffer.

\* Many coatings are postcured, which requires spraying with water after application.



and to provide better adherence to steel. The silane also facilitates mixing with the zinc. The original formulations<sup>2</sup> are given in Table 1. The coating has a water base and is nontoxic and nonflammable.

#### Test Performance

Ten panels coated with formulations of NASA's zinc-dust composition were placed in the salt spray chamber at the California Department of Transportation's Materials and Testing Laboratory on March 11, 1974. The formulation selected for this test was:

	<u>Percent by Weight</u>
Potassium silicate solution 20K 5.3	17.6
Methyltrimethoxysilane	0.4
Zinc dust, 325 mesh	82.0

Seven of the panels were given the following antifouling topcoats (developed for use on Navy vessels):

- Urethane-polyester (vinyl phenolic tiecoat)
- Epoxy (vinyl phenolic tiecoat)
- Vinyl acetate
- Vinyl acetate (vinyl phenolic tiecoat)
- Chlorinated rubber (vinyl phenolic tiecoat)
- Vinyl chloride (vinyl phenolic tiecoat)
- Vinyl chloride GW (vinyl phenolic tiecoat)

All three panels coated with the zinc-dust formulations alone gave excellent performances, with no rusting or blistering after 5300 hours in the salt spray chamber (Figure 1). The vinyl acetate with vinyl phenolic tiecoat also withstood a 5300-hour test with no sign of corrosion (Figure 2). California engineers consider a coating superior if it endures a 3000-hour test (3% brine), whereas the paint industry places its test requirement as high as 4000 hours.

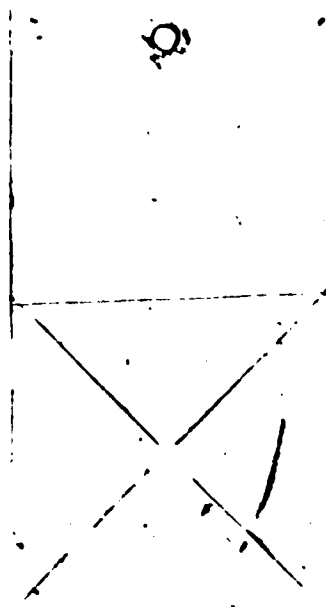
Table 1  
PREFERRED FORMULATIONS\* OF NASA'S ZINC-DUST COATING

Component	Parts by weight	Percent by weight	Component	Parts by weight	Percent by weight
<b>Example I</b>					
Potassium silicate solution 20% 5.3 †	64.5	21.0	Potassium silicate solution - 22% 4.8	64.5	21.2
Methyltrimethoxysilane	2.0	0.6	Methyltrimethoxysilane	2.0	0.6
Zinc dust	240.0	78.4	Zinc dust	240.0	78.2
	306.5	100.0		306.5	100.0
(After 4 hours air drying, the coating was assayed at 94.4% Zn + silicene)					
<b>Example II</b>					
Potassium silicate solution 22% 4.8	64.5	26	Potassium silicate solution - 20% 5.3	64.5	21.2
Zinc dust	180.0	74	Zinc dust	240.0	78.8
	244.5	100		304.5	100.0
<b>Example III</b>					
Potassium silicate solution 20% 4.8	64.5	21.2	Potassium silicate solution - 19% 5.3	64.5	17.6
Zinc dust	240.0	78.8	Zinc dust	300.0	82.0
	304.5	100.0	Methyltrimethoxysilane	2.0	0.4
				366.5	100.0

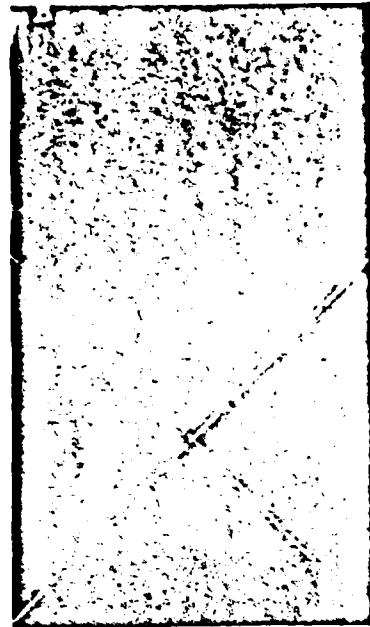
\* Each of the above formulations was sprayed on steel surface, air dried at ambient temperature for 4 hours, and visually and microscopically examined. In each case a firm adherent film was produced. The compositions containing the methyltrimethoxysilane appeared slightly more adherent when subjected to scraping tests and evidenced a more glossy finish.

Source: NASA Technical Support Package for Tech Brief 70-106000, "Potassium Silicate / Zinc Dust Coating."

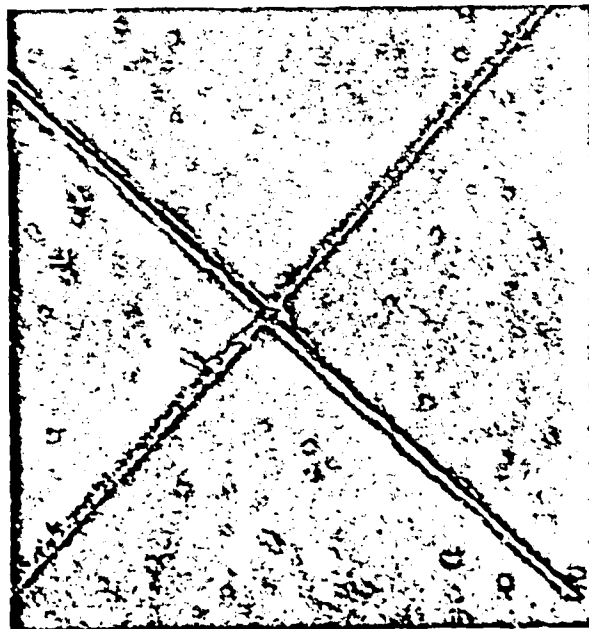
\* The first number refers to the percent by weight of potassium silicate in aqueous solution, the second refers to the mole ratio of silica to potassium oxide.



(a) WITH VINYL ACETATE  
FINISH COAT



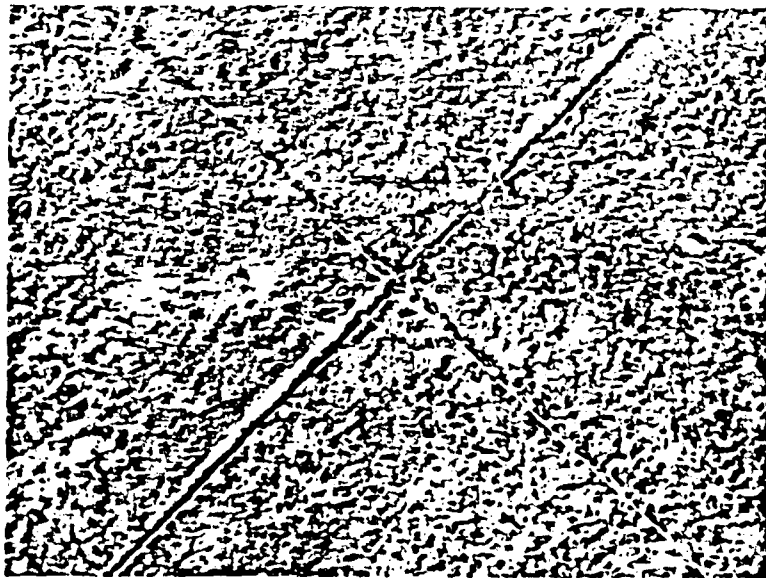
(b) FINISH COAT AND ZINC  
PRIMER REMOVED



(c) SAME AS (b), MAGNIFICATION 3X

SA-3670-2

FIGURE 1 NASA'S POTASSIUM SILICATE ZINC DUST COATING AFTER  
5300-HOUR SALT SPRAY TEST—NO SIGN OF CORROSION



MAGNIFICATION 3X

SA-3670-8

FIGURE 2 NASA'S POTASSIUM SILICATE ZINC DUST COATING  
AFTER 5300 HR SALT SPRAY TEST

### Tests of Commercial Coatings

Fifty-nine zinc-rich coatings, all available commercially, were exposure tested at Kennedy Space Center (KSC).<sup>3</sup> Seventeen were able to endure the 18-month test by completely resisting corrosion and adhering uniformly; however, only nine performed well in the abrasion test\* (see Table 2). Figure 3 shows some of the coatings that were reported to perform poorly. All coatings were applied at 4 to 6 mils dry film thickness in accordance with KSC-SPEC-F-0020 with no top coat. Conclusions drawn from these tests were:

- Inorganic zinc-rich coatings are far superior to organic ones in the aggressive KSC seacoast atmosphere.
- Topcoats are not necessary, or even desirable, in conjunction with inorganic zinc-rich coatings in the KSC environment.
- The best performers were the hardest to apply.
- Nine commercial products (all inorganic) resisted corrosion and abrasion.

After 36 months, all the inorganics listed below continued to perform well.

<u>Solvent-Base</u>	<u>Water-Base</u>
Carbo Zinc 11, Carboline Corporation	Inorganic Zinc #1, Koppers Co.
Cutha Cote 300, Devoe & Reynolds Company	Zinc 1, Mobil Chemical Co.
Ganacin Inorganic 347-931, E.I. du Pont de Nemours & Company, Inc.	Napko 4Z, NAPCO Corporation
Durazinc 525, Southern Imperial	Zinc-clad 8, Sherwin Williams Co.
Plasite 1000, Wisconsin Protective Coating Corporation	

Florida provides a grueling test environment. Studies conducted by the Rocky Mountain Society for Paint Technology and by the State of Delaware compared their exposure areas with the Florida environment.<sup>4,5</sup> In both cases, specimens at the Florida test site eroded sooner, indicating

\* Federal Test Method Standard 141a, Method 6192, using a Tabor Abrader equipped with CS-17 wheels and a 1000-gram load.

Table 2  
SURVEY OF ZINC-RICH PAINTS  
(August 1974)

Company	Identification	No Rusting/Blistering		Coats		
		RSC 10-yr Field Test	Alaska 2-yr Field Test	Primer	Topcoat	Cost (\$/sq ft)
Amprom Inc., Wren, Co.	Dimetecote-b (D-6) (alkyl silicate)	X		1 (4-6 mils)		\$21.75 (5-gal. lots)
* Carboline Co., St. Louis, Mo.	Carbo Zinc II (silicate)	X		1 (4-6 mils)	1	
Cook Paint & Varnish Co., St. Kansas City, Mo.	Epicon H-Zinc 920-A-170	X		1 (3 mils)	1	\$11.00
* Devco & Reynolds Co., Newark, N.J.	Catha Cote 300 (post-cured silicate)	X		1 (4-6 mils)	1	Discontinued
Debesvoss Brooklyn, N.Y.	Debanode 587 Organic		X	1 (2 mils)	2	\$11.50
* E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.	Ganadin Inorganic 347-9J1	X		1 (2 mils)	1 (2 mils)	\$10.75 (5-gal. lots)
Exxon Chemical Co., (formerly Enjay) Houston, Texas	Rustban 191 (silicate)	X	X	1 (6-9 mils)		\$25.00 (5-gal. lots)
				2 (2 mils)		
Glidden-Durkee Cleveland, Ohio	Zinc dust primer (inorganic)		X	2 (4-5 mils)		\$12.00 (5-gal. lots unmixed binder)
				1 (2 mils)		
* Koppers Co., Inc., Pittsburgh, Pa.	Inorganic Zinc #1 (post-cured lead silicate)	X		1 (2 mils)	1	\$21.00 (5-gal. lots)
* Mobil Chemical Co., Azusa, Ca.	Zinc 1 (metallic silicate)	X		1 (4-6 mils)	1	\$11.00 (5-gal. lots)
Mobil Chemical Co., Azusa, Ca.	Zinc 4 (organic epoxy)	X		1 (4-6 mils)	1	\$10.24 (5-gal. lots)
* NAPKO Corporation Houston, Texas	Napko 17 (self-curing inorganic silicate)	X		1 (2-6 mils)	0	\$22.00 (5-gal. lots)
NAPKO Corporation	Napko 27 (polyhydrous ether resin)	X		1 (3-6 mils)	0	\$10.50 (5-gal. lots)
Metallum Corp., Frankton, Ill.	Metallic Galvanoleum 216		X	2 (1.5 mils)	0	\$11.40 (5-gal. lots)
Seaguard Portsmouth, Va.	Seaguard 6 (single component)	X		1 (1-6 mils)	1	*
* Sherwin Williams Cleveland, Ohio	Zinc-Clad B (inorganic silicate)	X		1 (1-6 mils)		\$23.80
* Southern Imperial New Orleans, La.	Durozinc 525 (inorganic silicate)	X		1 (1-6 mils)	1	\$20.80 (5-gal. lots)
* Wisconsin Protective Coating Corp.	Plasite 1000 (inorganic silicate)	X		1 (1-6 mils)		\$12.00
Wisconsin Protective Coating Corp.	Plasite 1636 (organic epoxy)	X		1 (1-6 mils)		\$12.00
Zinc Lock Co., Tomball, Ca.	Zinc Lock 351 (silicone)	X		1 (4-6 mils)		\$11.00 business

\* Passed RMC abrasion test: Federal Test Method Standard 1412, Method B192, using a Labor Abrader equipped with  
CS-17 wheels and a 100-gram load.

\* No response to inquiry

Source: SRI

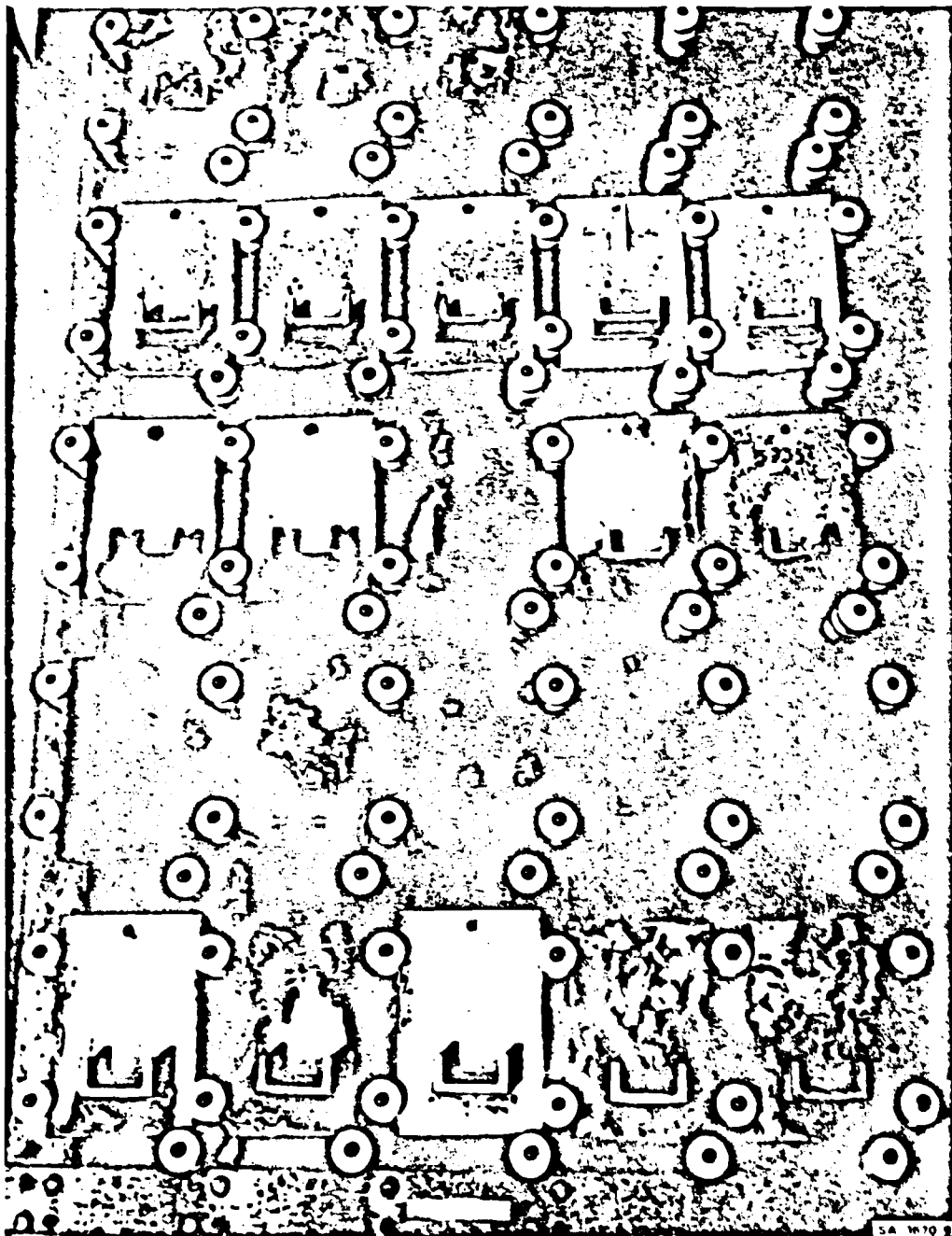


FIGURE 3 MISCELLANEOUS COATING FAILURES AT KSC TEST SITE

that the combination of moisture, humidity, and salt fog is a more damaging environment than moisture or salt fog alone or high altitude.<sup>4</sup>

Field tests were also conducted at Fairbanks, Alaska, by the Alaska Highway Department. Four coatings that performed well during this 2-1/2 year test (early 1971 to mid-1973) are included in Table 2.

#### Competitive Formulations

Many of the inorganic materials used in the past are reported to have solved most of the problems of metal coatings, such as poor adherence, poor finish characteristics, and uneven coverage. Generally the solution is stated to lie in use of an alkali metal silicate solution as the vehicle. Specific formulations have been proposed, using sodium silicate in a mole ratio of sodium oxide ( $\text{Na}_2\text{O}$ ) or potassium oxide ( $\text{K}_2\text{O}$ ) to silica ( $\text{SiO}_2$ ) greater than the normal 1:2, preferably between 1:2.3 and 1:3.0. Even with these modifications in component ratios, however, the techniques require that additive components be incorporated into the composition to provide or enhance the requisite properties. These additives include lead chromate to render the coating insoluble or a fatty acid for spreadability and adhesion. Further suggestions include overcoating with acid formulations to ensure neutralization, particularly when corrosive environments are encountered.

In practice, however, these proposals have not proved totally satisfactory. The principal problem has been that each time a new material is added to solve one problem, other problems are accentuated. Several examples are given below.

"Galvanite" baked coatings of sodium silicate pigments with zinc dust have shown no evidence of deterioration nine years after application to 240 miles of overland pipe in Australia.<sup>6</sup>

Disadvantage: Need for baking.



Organic zinc-rich coatings are actually primers, not coatings. For all practical purposes, organics are not considered one-coat systems. With a finish coat, the organic still provides less protection than an inorganic without a topcoat.

Disadvantages: Require finish coat  
Shorter life.

Alkyl silicate primers, when hydrolyzed to a level of about 80%, require no further processing. They use high-purity zinc dust having a controlled particle size distribution (6 micron average). Several additives, such as alkyl borates, are needed to produce a continuous film. Since the borates are water soluble, their silicate complexes are also sensitive to moisture. An example of an alkyl silicate formulation is provided in Table 3.

Advantages: May be stored at temperatures below 32°F  
May be applied in wet weather

Disadvantages: Atmosphere moisture causes binder to gel  
Limited pot life after mixing  
Coating tends to run.

Vinyl primers are particularly applicable to water service. The zinc is combined with a vinyl solution. Just before mixing, a silane adhesion promoter is added. An example of a vinyl primer is given in Table 4.

Disadvantage: Organic primer--shorter life; requires finish coat

Phenoxy primers are the only single-package coatings; that is, the zinc dust is premixed with the binder. Solvents, such as methyl ethyl ketone, dissolve the phenoxy resin; suspending agents, such as xylene, prevent hard settling of the zinc dust. Molecular sieves are used to absorb moisture in the finished formulation and thus minimize gassing.

Table 3

## ALKYL SILICATE ZINC-RICH PRIMER FORMULATION

(MP-3513)

	Formulation (lb/100 gal)
Component I (vehicle)	
Cellosolve silicate X-8018	698
Trimethylborate <sup>(1)</sup>	12.5
Fumed silica <sup>(2)</sup>	12.5
Component II	
Zinc dust <sup>(3)</sup>	1132
<u>Properties</u>	
Vehicle properties	
Flash point (tag closed cup), °F	110
Hydrolysis level, (approximate), %	80
Type of solvent	Cellosolve
Paint mixed with zinc dust	
PVC, %	61.14
Weight per gallon, lb	18.56
Nonvolatile, % by wt	72.14
Zinc dust in total dry film, %	82.25
Film properties (3.0 mils dry)	
Set to touch, minutes	40
Dry to handle, hours	6
Dry to topcoat, hours	48
1000-hours salt fog	Excellent
1000-hours Cleveland humidity	Excellent
1000-hours fresh water immersion	Excellent

(1) 70% azeotrope of TMB, Ventrol Corporation

(2) "Cab-O-Sil 11" H5, Cabot Corporation

(3) "Federated" No. 111, ASARCO, "Standard" No. 144, New Jersey Zinc Co.  
or equivalent

Source: Union Carbide Corporation

Table 4

## ORGANIC ZINC-RICH PRIMER FORMULATIONS

<u>Components of Phenoxy</u> <u>Zinc-Rich HP-3662<sup>(1)</sup></u>	<u>Formulation</u> <u>(lb/100 gal)</u>	<u>Components of Vinyl</u> <u>Zinc-Rich VZ-108c<sup>(2)</sup></u>	<u>Formulation</u> <u>(lb 100 gal)</u>
Bakelite phenoxy resin PKHH	123.0	Component A	
MFA-60 xylene <sup>(3)</sup>	6.5	Bakelite vinyl resin VYHH	109.2
Cellosolve acetate	432.5	Methyl n-butyl ketone	397.1
Toluene	86.7	Methyl ethyl ketone	137.0
Linde molecular sieve 4A	10.7	"Bentone" 14 <sup>(4)</sup>	4.6
Zinc dust 22 <sup>(5)</sup>	1197.8	"Bentone" 27 <sup>(4)</sup>	2.7
		Methanol	3.3
		Red iron oxide R-6098 <sup>(6)</sup>	7.9
		Component B	
		Union Carbide A-1120 silane	4.1
		Component C	
		Zinc dust 222 <sup>(5)</sup>	550.0
		<u>HP-3662</u>	<u>VZ-108c</u>
		<u>Properties</u>	<u>Properties</u>
Vehicle properties			
Flash point (tag closed cup), °F		80	Below 60
Type of solvent		Cellosolve acetate	Ketones
Paint mixed with zinc dust			
PVC, %		62.55	49.7
Weight per gallon, lb		18.57	12.17
Nonvolatile, % by wt		71.77	55.8
Zinc dust in total dry film, %		89.85	81.06
Film properties			
Set to touch, minutes		15	10
Dry to handle, minutes		60	15
Dry to topcoat, hours		4	1
Primer plus vinyl topcoat system			
1000-hours salt spray		Excellent	Excellent
1000-hours Cleveland humidity		Excellent	Excellent
1000-hours fresh water immersion		Good (few blisters)	Excellent

(1) Suggested for California Spec. 721-80-62

(2) Corps of Engineers, U.S. Army, CE-1409

(3) Baker Castor Oil Company

(4) NL Industries

(5) New Jersey Zinc Company

(6) Pfizer Chemical Company

Source: Union Carbide Corporation

An example of a phenoxy zinc-rich formulation is also given in Table 4.

Advantages: Single-package application

Disadvantages: Organic primer--shorter life; finish coat required.

Aluminum-zinc-rich coatings being developed at Alcoa substitute 10% aluminum for zinc. Aluminum is currently less expensive than zinc and may have other advantages.

Possible advantages: Retards gelling of binder

Potential one-package system.

#### Coating Application

The application process is generally considered the primary barrier to complete acceptance of inorganic zinc-rich coatings. During a presentation at the National Zinc Conference in Chicago, December 1974, Mr. J. L. Manta, President of J.L. Manta, Inc., a Chicago paint contractor, expressed his opinion that the steel surface must be sandblasted white-clean (no stains, no pits, no grease or dirt) for the inorganic primer to adhere. Manufacturers of inorganics contend that only a near-white surface is required. That is, the surface must be free of grease, dirt, and paint but may contain stains and mill scale binder. The heavier the steel, the harder it is to clean.

When the sandblasting (or steel grit blasting) is done in the open, as is necessary for bridge members, a dry abrasive of uniform grain size is discharged through a nozzle outlet of specific size at a predetermined pressure. With a 3/8-inch-diameter nozzle and a 90-pound air pressure, 3 to 6 ft/min, can be cleaned with 72 pounds of abrasive.

\* NACE (National Association of Corrosion Engineers) Standard No. 1

† Steel Structures Painting Council Surface Preparation Specification No. 10.

Like other inorganics, the NASA coating is a two-component system. The zinc dust must be combined with the binder at the site. The mixing step is eliminated by using air spray equipment that contains an agitator. The spray gun should be held close to the structure so that coating is sprayed wet and zinc dust is not lost.

The NASA coating is applied at a dry film thickness of 2-3 mils. One gallon is reported to cover 375 square feet, whereas the usual coverage for inorganics is about 200 square feet per gallon. The potassium silicate binder appears to be easier to apply than the more common ethyl silicate. If necessary, a second coat or a topcoat may be applied after 24 hours. Complete self-cure requires five days.

? Surface preparation

# SECTION H

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STATE OF ALABAMA  
HIGHWAY DEPARTMENT

MONTGOMERY, ALABAMA 36130

FOR JAMES  
GOVERNOR

October 5, 1979

REX K. RAINER  
HIGHWAY DIRECTOR

Artech Corporation  
2901 Telestar Ct.  
Falls Church, VA 22042

Attention: Mr. Fred Ordway  
Executive Vice President

Dear Sir:

Attached is a xerox copy of our Special Provision No. 1533 covering our general requirements for zinc rich organic paint as requested in your recent letter. Since our requirements have been limited to organic types we have not prepared or published any specifications covering the inorganic type.

If we may be of any further assistance, please do not hesitate in advising us.

Yours very truly,

Edward Eiland  
Materials & Tests Engineer

By Ralph Crook  
Ralph Crook  
Assistant Testing Engineer

WRC/c  
cc: Mr. Jack Springer  
File

Attachment

STATE OF ALABAMA HIGHWAY DEPARTMENT

DATE: July 27, 1979

Special Order No. 132

SUBJECT: Zinc Rich Organic Paint System, Project No. 4-600-00-015-016,  
Edwin and Leona Corntass.

Alabama Standard Specifications, 1976 Edition, are hereby amended as follows:

SECTION 521  
STEEL BRIDGE PAINTING

521.01 MATERIALS.

This Article shall be amended to include the following:

For the purpose of this project, the paint system to be used shall be limited to the following:

Zinc Rich Organic Paint System.

General Requirements.

This paint system is to be used on structural steel and shall include an Organic Zinc Primer, a tie coat, if required, and a compatible topcoat. All coatings shall be supplied by the same paint manufacturer.

Composition.

1. The composition of the primer shall meet the following requirements:

Total Solids, % by Weight of Primer	80% Min.
Zinc, % by Weight of Primer	75% Min.
Volatile Solids, % by Weight of Primer	5% Min.
Metallic Zinc, % by Weight of Solids	80% Min.
Weight per Gallon	19 lbs. Min.
Flash Point, closed cup	80°F. Min.

\* Zinc Dust shall conform to the requirements of FSS TT-P-460 Type 1

2. The composition of the tie coat, if required, shall be as recommended by the paint manufacturer.

3. The composition of the finish or topcoat shall be as recommended by the paint manufacturer and shall be suitable for the purpose in intended. The generic type shall be either a high build Epoxy or a high build Urethane. The color of the dried film shall be "battleship gray" and shall match the standard established by the Alabama State Highway Department.



Qualification and Sampling.

The paint system furnished under this specification shall be a product that has been tested and has passed the acceptance tests specified hereinafter. Any change in the formulation of an approved system will necessitate its requalification. The materials supplied under the contract shall be identical, within manufacturing tolerances, to the products receiving approval.

Prior to the application of any paint system, the Contractor shall submit samples to the Engineer for acceptance testing by the laboratory. Sufficient identifiable characteristics other than trade or brand name or designated number or symbol shall be provided to permit laboratory test verification of coating identity. These characteristics shall include formulation information readily derivable in the laboratory including the general nature of the vehicle, pigment and volatile portion, the weight per gallon, the percent solids by volume and other procedures used for quality control during manufacture of the coating.

In addition to quantitative analysis of the coatings, the paint system shall be subjected to the following accelerated tests prior to acceptance. The Contractor shall submit certified test reports to the Engineer showing that the following tests have been performed on the paint to be used and the results of each test.

1. Weatherometer Exposure.

Exposure of topcoat for 1500 hours with weatherometer conditions as follows:

Dry Bulb Temperature	125°F.
Wet Bulb Temperature	130°F.
Black Panel Temperature	145°F.
Water Spray	20 psi

2. Salt Fog Exposure.

Exposure of organic zinc primer for two weeks with salt cabinet conditions as follows:

Salt Solution	Saturated
Cabinet Temperature	135°F.

Acceptance of the total paint system will be granted subsequent to successful completion of the aforementioned tests. Approval consists of the primer and its respective topcoat with no intermixing of various manufacturer's products.

521.03 (a) 4. Number, Thickness and Color of Coats.

This Item shall be amended to include the following which shall be applicable to this project.

All metal work shall be painted with a two coat Zinc Rich Organic Paint System consisting of a prime Organic Zinc Primer, a tie coat, if recommended by the manufacturer, and a suitable top coat tinted to a gray color matching a standard established by the Alabama State Highway Department. The surface dry

The thickness of the coatings shall be 3.0 mils for the primer and 4.0 mils for the topcoat. The color of the various coatings shall be sufficiently different to readily permit the discovery of an incomplete application of the coatings.

521.03 (c) Repainting Old Bridges.

This Subarticle as written shall be deleted and the following substituted in lieu thereof:

1. Cleaning Metal.

All exposed portions of steel and other metals shall be cleaned and sealed. Steel and other metals shall consist of the metals of the substructure and superstructure structural steel areas and contiguous metal surfaces, and such surfaces as galvanized pipe, conduits and junction boxes, metal ladders, gratings, railings, platforms, operator's houses (metal or of other material), navigation light stands, gavel masts, supporting overhead cable (excluding public utility masts, cable, brackets and appurtenances), traffic gate housing, metal drains on steel spans and surfaces of all machinery housing and parts that do not require lubrication. All cleaning and sealing of such metals as listed herein shall be accomplished by use of sand blasting equipment. Any cleaning and sealing that is deemed by the Engineer to be harmful to the metal shall be discontinued.

Surfaces that are designated to be cleaned shall be cleaned in accordance with the "Steel Structures Painting Council's Surface Preparation Specification No. 6, Commercial Blast Cleaning," unless a more stringent requirement is recommended by the paint manufacturer. The appropriate SSPC visual standards shall be used to establish the final appearance of the blast cleaned steel before painting. The height of profile (anchor pattern) may vary from one (1) to four (4) mils after blasting as recommended by the paint manufacturer's brochures. Oil and grease shall be removed by the use of a suitable solvent. Bristle brushes or compressed air shall be used for removing loose dirt.

2. Application of Paint.

a. General.

Paint shall be applied by the method recommended by the paint manufacturer in accordance with the provisions of Item 521.03(a)2.

In no case shall a succeeding coat be applied until the previous coat has dried throughout the full thickness of the paint film. No paint shall be applied over dirt, grease or other foreign matter. Oil and grease shall be removed by the use of a suitable solvent. Care shall be taken not to damage an underlying paint coat; however, if damage occurs, the underlying coat(s) shall be immediately repaired.

b. Primer Coat.

No primer shall be applied until the surface has been inspected and approved.

The primer coat of paint shall be applied within twenty-four (24) hours after cleaning. Under no circumstances shall the steel be permitted to rust before painting, regardless of the time elapsed.

The film thickness of the primer shall be as noted in Item 521.03(a)4.

c. Tie Coat, if Required, and Top Coat.

No tie coat or top coat shall be applied until the primer coat has been allowed to thoroughly dry and has been inspected and approved. Any unacceptable areas shall be repaired in accordance with the paint manufacturer's recommended practice.

The tie coat, if required, shall be applied to all primed surfaces with a film thickness in accordance with the paint manufacturer's recommendation.

The top coat shall be applied to all previously treated surfaces with the specified film thickness noted in Item 521.03(a)4.

3. Protection of Paint Coats and Structural Joints.

The paint coats shall be protected to the extent practicable from discoloration or disfigurement by dust, fumes or other cause not being. The Contractor shall protect pedestrian, vehicular and other traffic underneath the bridge and also all portions of the bridge not to be painted against damage or disfigurement by spray, spatters, splashes and sprines of paint or paint material. If in the opinion of the Engineer, traffic produces an objectionable amount of dust, the Contractor shall, without extra compensation, lay the dust for the necessary distance on each side of the bridge, and take any other precautions necessary to prevent dust and dirt coming in contact with freshly painted surfaces. It shall be the Contractor's responsibility to protect all property, public and private, from paint damage.

# STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES  
Division of Highway Design & Construction

P. O. BOX 1467  
JUNEAU, ALASKA 99802

October 2, 1979

OCT. 2 1979

Re: Zinc-rich paints.

Artech Corp.  
2901 Telestar Court  
Falls Church, Virginia 22041

Attention: Fred Ordway

Gentlemen:

Your letter of September 19, to Mr. Doyle Ross has been referred to this office for response.

The State of Alaska has no standard specification for zinc-rich paints or primers. Although we have used zinc-rich paints, our experience - - - especially in marine environments - - - has been discouraging due to early failure of the protective system. We have since gone back to red lead paint with a vinyl top coat.

When zinc-rich paints were used, our specification ~~included~~ a proprietary listing of inorganic zinc products lifted from the NAVSHIPS spec. sheet.

Very truly yours,

*Karl Nielke*  
for D. E. Halsted  
Chief Bridge Engineer

**FORMULA No. 4-75, Traffic Line, Highway**

Paint TT-P-115, Type III

Colors:

37875 - White  
33538 - Yellow**FORMULA No. 5-75, Primer, Paint, Zinc-Chromate**

Paint TT-P-645

Color: Yellow

**FORMULA No. 6-75, Primer, Paint, Exterior**

Paint TT-P-25

Color: White

**FORMULA No. 7-75, Enamel, Alkyd, Semi-Gloss**

Paint TT-E-529, Class A, air drying

Color:

24172 - Forest Green

**FORMULA No. 8-75, Enamel, Alkyd, Semi-Gloss**

Paint TT-E-529, Class A, air drying

Colors:

27875 - White  
26492 - Gray, which is obtained by adding  
carbon black to the white 27875.**FORMULA No. 9-75, Epoxy, Two-Component for Metal, Wood,  
Concrete and Masonry.**

Paint TT-C-535

Colors:

24172 - Forest Green  
27875 - White**FORMULA No. 10-75, Aluminum Paint, Ready-Mixed**Paint TT-P-38, except the vehicle shall meet Federal  
Specification TT-V-81**FORMULA No. 11-75, Paint, Latex Enamel, Gloss and Semi-Gloss**Paint TT-P-001511, except vehicle shall be a 100% straight  
acrylic polymer dispersed in water

Color:

27875 - White and Tints

**FORMULA No. 12-75, Paint, Exterior, Chrome Green**

Paint TT-P-71

Color:

14110 - Dark Green

**FORMULA No. 13-75, Paint, Latex, Acrylic Emulsion, Flat**

Paint TT-P-19

Colors:

37875 - White  
36492 - Gray by adding carbon black to  
white 37875  
34672 - Light Building Green**FORMULA No. 14-75, Primer, Surfacer, Synthesic**

Paint TT-P-659

Color: White

**FORMULA No. 15-75, Enamel, Alkyd, Gloss**

Paint TT-E-489, Class A, air drying

Color:

17875 - White

**FORMULA No. 16-75, Enamel, Alkyd, Gloss**

Paint TT-E-489, Class A, air drying

Color:

17038 - Black

**FORMULA No. 17-75, Enamel, Alkyd, Gloss**

Paint TT-E-489, Class A, air drying

Color:

13538 - Yellow

**FORMULA No. 18-75, Enamel, Alkyd, Gloss**

Paint TT-E-489, Class A, air drying

Color:

13655 - Lemon Yellow

**FORMULA No. 19-75, Self-Cure Zinc Silicate-Ethyl Silicate Vehicle**Description:

This specification covers a two component self-curing ethyl silicate vehicle type zinc silicate paint which when mixed and applied in accordance with specification requirements, shall cure without the use of a separate curing solution to a coating having the properties described herein.

Composition:

**Component A, Pigment Composition.** The pigment shall consist of finely divided zinc powder containing a minimum of 88 percent metallic zinc and 98 percent total zinc by weight using Federal Test Method Standard No. 141, Method 722. The average particle size shall be not greater than 9.0 microns as determined by the Fisher Subieve. The pigment shall have a specific gravity of not less than 7.00 nor more than 7.14 as determined using the procedure set forth in ASTM D 153.

**Component B, Partially Hydrolyzed Ethyl Silicate Vehicle.** The ethyl silicate used in the hydrolysis reaction in the preparation of

*Idaho std. Spec. for  
Highway Construction  
1976*

the vehicle shall contain at least 40 percent silicon dioxide.

**Vehicle Composition:**

Pyrazolone red, a dry pigment, shall be dispersed in the vehicle at the rate of 0.5 percent of the weight of the vehicle. It shall be so dispersed as to yield a grind of 6 Hegman, minimum. The vehicle without pigment shall have the following composition:

**Parts by Weight**

Ethyl Silicate, 40% SiO <sub>2</sub> content	27.7
Polyvinylbutyral resin, to correspond to the resin used in Federal Specification MIL-P-15328	5.5
Secondary Butyl Alcohol TT-B-838	42.6
Cyclohexanone	5.4
1,1,2-Trichloroethane	5.4
2-Nitro Propane	5.5
Diocetyl Sodium Sulfosuccinate, solution in normal Propyl Alcohol of a 75% solution in distilled water	0.4
Hydrochloric Acid, 0.25% solution of Hydrogen Chloride Gas	2.9
Normal Propanol	4.5
<b>Vehicle Properties:</b>	
Non-volatile at 105° C, percent by weight	23.0-25.0
Viscosity, Brookfield, Model RVT, No. 1 spindle at 50 rpm, poises	0.85-1.50
Weight per gallon, pounds at 77° F	7.6-7.8
Silicon dioxide equivalent	10.8 min.
Storage life at 77° F, months	6 min.
Viscosity at 77° F, after 72 hours at 140° F, Brookfield, Model RVT No. 1 spindle at 50 rpm, poises	1.85 max.
pH of vehicle, Hydron paper	2-5

**Mixed Paint Properties:**

The zinc dust shall be mixed with the vehicle in the ratio of 13.5 pounds per gallon of vehicle just before use. The mixed paint shall have the following properties:

Weight per gallon at 77° F, pounds . . . . . 17.2 min.  
Viscosity, KU at 77° F . . . . . 70-80

Viscosity, KU at 77° F, after 24 hours . . . . . 80 max.  
Non-volatile at 105° C, percent by weight . . . . . 72.0 min.  
Dry time at 77° F, and 50% relative humidity,  
6 mil wet thickness . . . . . % max.  
Set to touch, hours . . . . . 2 max.  
Dry, hard, hours . . . . . 2 max.

**Properties of Cured Coating:**

A certification shall be provided certifying that the manufacturer's formulation complies with the foregoing formulations and properties for Formula No. 19-75, and further that the formulation being furnished has been tested and complies with the following:

When applied to plate glass panel with a 6-mil gap doctor blade and cured for 15 days at a relative humidity of 95-100 percent, the coating shall have a pencil hardness greater than H.

When a steel panel is sandblasted to white metal and coated with not less than a 3 nor more than a 4-mil dry film thickness of this coating and cured for 7 days at 50 percent plus or minus 5 percent relative humidity and diagonally scribed to expose bare steel, there shall be no corrosion on the surface of the coated panel after 3,000 hours when tested according to ASTM B 117. When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on sandblasted steel having an anchor profile pattern of 1 to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by sandblasting to produce a 1- to 1.5-mil anchor pattern, and cured for 15 days at a relative humidity of 50 percent plus or minus 5 percent and tested according to the Conical Mandril Test, Federal Test Method Standard No. 141, Method 6222, the minimum elongation shall be 10 percent. There shall be no loosening of the film above the point of the longest continuous crack.

**707.03 Certification.** The Contractor shall furnish a Manufacturer's Certificate, in quadruplicate, for quantities in excess of 5 gallons of any one formulation as provided in subsection 106.04.

**707.04 Packaging.** Each container shall be plainly labeled as to contents, Federal Specification, or other

specified Formula Number, batch number, and/or other approved identification.

*Formula No. 1935, Self Cure Zinc Silicate*

The label for zinc silicate paint shall state that containers of unopened material must be kept tightly sealed, and the paint must be used within 12 hours from the time it was mixed when the temperature does not exceed 77°F; between 77°F and 90°F the paint shall be used within 6 hours; and at temperatures above 90°F the paint shall be used within 4 hours. The sealed containers of mixed paint not used within the above time limits will not be accepted.

Complete instructions for mixing and use shall be included with each container of paint.

The paint shall be packaged so one unit of the pigment may be mixed with one unit of the vehicle.

## SECTION 708 - METALS

**708.01 General.** When metal is placed in the work, it shall be free from dirt, detrimental scale, paint, oil, or other foreign substance. Thin powdery rust and tight rust are not considered detrimental except in the case of prestressing reinforcement.

**708.02 Reinforcing Steel.** Welded Wire-Fabric for Reinforcement shall conform with the requirements of AASHTO M 55. Unless otherwise specified other reinforcing steel shall conform with the requirements of ASTM A 615, Grade 40 or 60.

**708.03 Dowel Bars.** Dowel bars shall conform to AASHTO M 254.

**708.04 Tie Bars.** Tie bars shall conform to AASHTO M 31, Grade 40 or 60. Tie bars shall be deformed.

**708.05 Prestressing Steel.** Prestressing steel shall be high-tensile wire conforming to ASTM A 421, high-tensile wire strand conforming to ASTM A 416, or high-tensile strength

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alloy bars conforming to the requirements in this subsection or any combination thereof.

In addition to the sizes of wire strand listed in ASTM A 416, 0.6-inch diameter strand may be used. Such strands shall conform to ASTM A 416 and the following:

Minimum ultimate strength (based on nominal area of strand)	270,000 psi
Nominal diameter of strand	0.6 inch
Breaking strength of strand	58,600 lbs. min.
Minimum yield strength at 1 percent extension	49,810 lbs.
Nominal steel area of strand	0.217 sq. in.

The diameter of the center wire must be at least 0.0035 inch larger than the diameter of the outer wire.

The mechanical properties of high strength prestressing bars shall conform to the following requirements:

325

# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT

Henry Gray, Director  
Telephone (501) 569-2000



P.O. Box 2261  
Little Rock, Arkansas 72203

September 26, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

4 OCT 1 P.M.

Dear Sir:

We are enclosing for your information and use copies of two specifications for zinc-rich primers of the inorganic type presently in use on Arkansas Bridge Maintenance projects. SP-1135 specifies the use of separately packaged inorganic vehicle and zinc dust and SP-1137 describes a single package inorganic zinc-rich primer.

Our experience with these primers indicates satisfactory performance when properly applied. Some blast cleaning and application problems have occurred which very quickly cause failure of the paint film. We use a commercial blast, SSPC-SP6, or better for these primers.

The same vinyl finish coat is described in both of these specifications and several problems have become apparent including adhesion, chaulking, ultraviolet deterioration and plasticizer extrusion. Improvements are needed in these formulations and the use of a suitable tie coat should be considered.

Please contact this department if we can be of assistance in this matter.

Yours truly,

J. D. Magness  
Engineer of Materials

Enclosure

WGW:kk



ARKANSAS STATE HIGHWAY DEPARTMENT

SPECIAL PROVISION 1135

PAINTING EXISTING STEEL BRIDGE STRUCTURES  
WITH TWO-COAT PAINT SYSTEM

1. SPECIFICATIONS: Specifications shall be the Arkansas Highway Commission Standard Specifications for Highway Construction as revised and amended by these Special Provisions.
2. DESCRIPTION: The purpose of these Special Provisions is to provide a two coat paint system consisting of an inorganic zinc primer and a vinyl finish coat for painting existing steel bridges. The work will consist of cleaning and painting steel bridge structures and shall include the proper preparation of the surfaces; the furnishing, application, protection and drying of the paint coatings; the protection against disfigurement by spatters, splashes and smirches of paint or of paint materials; protection of streams, lakes and reservoirs and the supplying of all tools, tackle, scaffolding and labor necessary to complete the work.
3. PAINT: 3.1 Inorganic Zinc Silicate Paint. The inorganic zinc silicate paint shall be a two component self-curing type which, when mixed and applied in accordance with specification requirements, will cure without the use of a separate curing solution to a coating having the properties described herein.

3.1.0 Composition.

3.1.1 Pigment. The zinc portion of the pigment shall be of a finely divided zinc powder containing, by weight, a minimum of 94 percent metallic zinc and a minimum of 98 percent total zinc. All fillers contained in the pigment shall be inert substances.

3.1.2 Vehicle. The vehicle component shall consist primarily of an alkyl silicate in an appropriate alcohol solvent. Total solids, by weight, in the vehicle component shall be not less than 21 nor more than 45 percent. The solids content shall be determined by drying the sample to constant weight at 100° C.

3.1.3 Mixed Paint. Mixed paint shall conform to the following requirements:

- (a) The zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.
- (b) The total solids, when heated at 100° C. for 3 hours, shall be not less than 80 percent by weight.
- (c) The paint shall tolerate up to one percent water contamination without gellation.
- (d) The usable pot life of the mixed paint shall be not less than 12 hours at 77° F. There shall be no hard setting which cannot be easily redispersed during the period.

3.1.4 Color. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the vinyl finish coat.

3.1.5 Resistance. Test panels of steel meeting the requirements of ASTM D 609-61 (1968) having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces as follows:

Surfaces to be painted with inorganic zinc paint shall be blast cleaned with abrasives producing a nominal height of profile of 1.5 mils. The blast cleaned surfaces shall meet the following requirements:

- (a) All oil, grease, dirt, rust scale and other foreign matter shall be completely removed except as hereinafter modified.
- (b) All rust, mill scale and old paint shall be removed except that very light shadows, streaks or discolorations caused by rust stain or mill scale oxides, or slight, tight residues of paint may remain.
- (c) At least 95 percent of each square inch shall be free of all visible residues and the remainder shall be limited to the light discoloration mentioned above.
- (d) Surfaces shall be cleaned to a condition at least equal to the appearance of the pictorial surface preparation standard, labeled SA 2½ in ASTM D 2200-67, that applies to the starting rust grade of the steel.

Surface cleaned to meet Steel Structures Painting Council Specification SSPC-SP10-63 will meet these requirements. A three mil coating (dry thickness) shall be applied to all surfaces of the test plates in accordance with the manufacturer's current instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

#### Fresh Water Resistance.

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F.} \pm 5^{\circ}\text{F.}$  The panels shall show no rusting, blistering or softening when examined after 30 days.

#### Salt Water Resistance.

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at  $75^{\circ}\text{F.} \pm 5^{\circ}\text{F.}$  The panels shall show no rusting, blistering, or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.

#### Weathering Resistance.

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panels or blistering.

#### Weathering and Salt Fog Resistance.

Panels shall be tested in the weatherometer as specified above for 300 hours. After this period, the panels shall be removed and scribed with an X of at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

Resistance to Elevated Temperature and Thermal Shock.

Panels shall be exposed to a temperature of 500°F. for one hour, then quenched immediately in 65°F. + 5°F. water. Panels subjected to this test shall show no blistering or flaking of the coating.

3.1.6 Application. The paint shall be capable of being applied to a 3 mil dry film thickness in accordance with specification requirements. The following requirements shall also be met.

- (a) After initial mixing, the paint shall be strained through a metal 30-60 mesh screen.
- (b) Stirring paddles on mechanical mixers shall reach to within 1 inch of the bottom of the stirring container during mechanical mixing.
- (c) Application shall be accomplished with suitable conventional spray or airless spray equipment.

3.1.7 Packaging and Labeling. Inorganic zinc paint shall be packaged in two compartment containers or in two separate containers. The components shall be packaged in such proportions that the pigment, when mixed into the vehicle in the vehicle container, will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of the paint, the lot number, date of manufacture and individual net weights of pigments and vehicle. The container shall be coated if necessary to prevent attack by the paint components.

3.2 Vinyl Paint. The vinyl paint for the finish coat shall be manufactured by the supplier of the inorganic zinc primer. It shall be well ground and shall not be caked, livered, skinned or badly settled in the container. The vinyl paint shall be compatible with and adhere to the cured, inorganic zinc primer film when applied directly over the organic zinc paint.

3.2.0 Composition.

3.2.1 Vehicle. The vehicle shall consist essentially of vinyl chloride copolymer resins dissolved in aromatic or ketone-aromatic solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

### 3.2.2 Mixed Paint.

- (a) Vinyl paint shall contain not less than 28 percent pigment by weight and 19 percent vehicle solids by weight for a total solids content of not less than 47 percent by weight. The weight per gallon at 77°F. shall be  $10.0 \pm 1$  pounds.
- (b) The vinyl finish coat shall air dry at temperature of 70°F. or above to a hard tough film within four hours, entirely by evaporation of solvents. It shall dry to touch in about 20 minutes at 70°F.

3.2.3 Color. The color of the finish paint shall match the Federal Standard 595 Paint chips as shown on Table No. I.

TABLE NO. I

COLOR	GREEN	ORANGE	GOLD	BLUE	RUST	ALUM	YELU
FED. STAND. NO.	24108	12246	23594	15177	20109	17178	1365

3.2.4 Application. The paint shall be capable of being applied to a 3 mil dry film thickness in accordance with specification requirements. The following requirements shall also be met.

- (a) The inorganic zinc primer shall have dried a minimum eight hours under normal conditions and all surfaces should be free of any soluble residue or excessive amounts of loose zinc before the vinyl finish coat is applied.

If the primer is exposed more than 24 hours, dust and dirt, which may have accumulated on the surface, shall be removed from the dried film with a soft brush or rags before application of the finish coat.

- (b) Application shall be accomplished with suitable conventional spray or airless spray equipment. A uniform coating free from runs and sags shall be produced. Brushing may be used for touchup or in areas inaccessible for spraying.
- (c) The vinyl finish coat shall not be applied when the surrounding air temperature is below 40°F. and shall not be applied when the temperature is expected to drop to 32°F. before the paint has time to dry.

3.2.5 Packaging and Labeling. Vinyl paint shall be supplied in a single package. All containers shall be approved by the engineer as to type and weight and shall be free of physical defects. All containers shall be cleaned of any paint spilled during filling operations. Vinyl paint shall be packaged in strong substantial 24 gauge or heavier, new metal containers having lug-type replaceable tops. They shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture and net weight of contents.

3.3 Manufacturer and Brand Name Approval for Inorganic Zinc Paint and Vinyl Paint.

Prior to approval and use of any inorganic zinc, the manufacturer shall submit in triplicate to the State Highway Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ration, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint and date of manufacture. Upon approval by the State Highway Department of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the State Highway Department when random sampling and testing of material offered for use indicated nonconformance to any of the requirements herein specified.

To obtain final acceptance of inorganic zinc or vinyl paint, the manufacturer shall furnish a certification in triplicate certifying that the materials supplied conform to all of the requirements specified, and for the inorganic zinc primer, stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The State Highway Department reserves the right to sample and test any or all materials supplied.

The State Highway Department reserves the right to discontinue approval of products that prove unsatisfactory.

4. CLEANING THE BRIDGE: The contractor shall, at his own expense, sweep clean the bridge floors of each span prior to starting painting operations on that span and keep the bridge floor clean until all work of painting has been completed and accepted for each individual span.

The contractor is cautioned that upon completion of the work and before final acceptance and payment is made, he shall be retained to remove all excess paint and foreign matter off the roadway and railing of the bridge and from piers and bents, as directed by the Engineer.

5. MAINTENANCE OF TRAFFIC: The bridge will be kept open to traffic at all times when paint is not being applied to the structure. When paint is being applied, the contractor may, with the approval of the Engineer, close the bridge to traffic, except as noted below, for periods not to exceed ten minutes at a time while paint is actually being applied to the structure. Following each closed period, the bridge shall be opened to traffic and painting operations stopped for a minimum similar period. The contractor shall exert every effort to hold inconvenience to the traveling public to a minimum and shall make use of such flagmen, signs and barricades as the Engineer may direct in the interest of safety and convenience. The use of signs, barricades and flagmen shall be governed by Section 107.10 of the Standard Specifications and the Manual on Uniform Traffic Control Devices published by the U.S. Government printing office.

When cleaning or painting structures over a multilane route, the contractor shall keep at least one lane of traffic open at all times in each direction of travel. Closing of lanes shall be done only at times approved by the Engineer.

It will be the contractor's full responsibility to protect the traveling public and adjacent property from flying particles of rust and other foreign matter during the cleaning operation and from flying paint during the painting operation.

6. SURFACE PREPARATION: All steel to be painted shall be cleaned by sandblasting to meet all the requirements of Steel Structures Painting Council SSPC-SP 6-63 Commercial Blast Cleaning, except that all old paint must be removed.

Sandblasting shall be performed using Ottawa flint silica 20-40 mesh or equivalent and shall produce an anchor pattern with a maximum depth of 2 mils and a dense and uniform pattern of ridges and depressions.

All rust bloom shall be removed by re-blasting before coating and the surface ahead of the coating operation shall be constantly and diligently examined for any traces of rust, oil, grease or other foreign blemishes not permitted by the blasting specifications.

7. WEATHER CONDITIONS AND DRYNESS OF SURFACE: Paint shall not be applied to any surface containing moisture discernible with the eye or by the following test for condensation. If it is suspected that temperature and humidity conditions are such that moisture is condensing upon the surface, the surface shall be moistened with a damp cloth so as to apply a clearly defined thin film of water; if this film evaporates and decreases after 15 minutes, the surface shall be considered safe to paint.

Paint will not be applied when, in the opinion of the Engineer, weather conditions may cause injury to fresh paint.

8. NUMBER AND THICKNESS OF COATS: Metal surfaces of structural steel which have been exposed in accordance with Section 6 of this Special Provision shall have applied one prime coat of inorganic zinc silicate paint and one finish coat of vinyl paint. The thickness of coating for both the primer and finish coats is to be 3 mils dry film thickness. The average total dry film thickness of the two-coat system shall be no less than 5.5 mils.
9. METHOD OF MEASUREMENT AND BASIS OF PAYMENT: Work completed and accepted under this item will be measured and paid for on a lump sum basis for "Painting Existing Steel Bridges with Two-Coat Paint System", which price shall be full compensation for sandblasting the metal surface, for painting the structure and for all labor, equipment, tools and incidentals necessary to complete the work.



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5-11-77

ARKANSAS STATE HIGHWAY DEPARTMENT

SPECIAL PROVISION 1137

PAINTING EXISTING STEEL BRIDGE STRUCTURES  
WITH TWO-COAT SINGLE PACKAGE PAINT SYSTEMS

1. SPECIFICATIONS: Specifications shall be the Arkansas Highway Commission Standard Specifications for Highway Construction as revised and amended by these Special Provisions.
2. DESCRIPTION: The purpose of these Special Provisions is to provide a two coat paint system consisting of a Single Package inorganic zinc primer and a vinyl finish coat for painting existing steel bridge structures. The work will consist of cleaning and painting steel bridge structures and shall include the proper preparation of the surfaces; the finishing application, protection and drying of the paint coatings; the protection against disfigurement by spatters, splashes, and smirches of paint or of paint materials; protection of streams, lakes and reservoirs, and the supplying of all tools, tackle, scaffolding and labor necessary to complete the work.
3. PAINT: 3.1 Single Package Inorganic Zinc Silicate Primer. The inorganic zinc silicate paint shall be a single component self-curing type, which, when applied in accordance with specification requirements, will cure without the use of a separate curing solution to a coating having the properties described herein.

3.1.0 Composition.

3.1.1 Pigment. The zinc portion of the pigment shall be of a finely divided zinc powder containing, by weight, a minimum of 94 percent metallic zinc and a minimum of 98 percent total zinc. All fillers contained in the pigment shall be inert substances.

3.1.2 Vehicle. The vehicle component shall consist primarily of an inorganic silicate in an appropriate alcohol solvent.

3.1.3 Mixed Paint. The mixed paint shall be homogenous, well dispersed, and shall have sufficient body to prevent excessive settling or hard caking of the pigment. Any settling or separation of pigment and vehicle shall be easily redispersed with a paddle and shall maintain uniform dispersion during use and for a period of several hours without stirring. Paint delivered to the job with viscosities in excess of the requirements as set forth below may be used with the permission of the Engineer, provide that the mixed paint when thinned meets the specification requirements. When paint is thinned on the job, a minimum of two field samples shall be taken at random during the life of the project and submitted for verification and approval.

The composition of the mixed paint shall conform to the following requirements:

- (a) The percent of zinc by weight in the dried film shall be a minimum of 80%.
- (b) The total pigment by weight shall be 64% minimum.
- (c) The total solids by weight shall be 68% minimum.
- (d) The total solids by volume shall be 48% minimum.  
(void content measurement method)
- (e) Weight per gallon shall be a minimum of 17.0 lbs. per gallon.
- (f) Viscosity shall be 70 to 90 K.U.
- (g) Pot life shall be indefinite in closed containers that have not been moisture contaminated.
- (h) Dry Time-shall be dry to touch in 30 minutes and dry to handle in 6 hours at 77°F and 60% Relative Humidity.

3.1.4 Color. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the vinly finish coat.

3.1.5 Resistance. Test panels of steel meeting the requirements of ASTM D 609-61 (1968) having dimension of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces as follows:

Surfaces to be painted with inorganic zinc paint shall be blast cleaned with abrasives producing a nominal height of profile of 1.5 mils. The blast cleaned surfaces shall meet the following requirements:

- (a) All oil, grease, dirt, rust scale and other foreign matter shall be completely removed except as hereinafter modified.
- (b) All rust, mill scale and old paint shall be removed except that very light shadows, streaks or discolorations caused by rust stain or mill scale oxides, or slight, tight residues of paint may remain.
- (c) At least 95 percent of each square inch shall be free of all visible residues and the remainder shall be limited to the light discoloration mentioned above.
- (d) Surfaces shall be cleaned to a condition at least equal to the appearance of the pictorial surface preparation standard, labeled SA 2½ in ASTM D 2200-67, that applies to the starting rust grade of the steel.

Surface cleaned to meet Steel Structures Painting Council Specification SSPC-SP10-63 will meet these requirements. A three mil coating (dry thickness) shall be applied to all surfaces of the test plates in accordance with the manufacturer's current instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

#### Fresh Water Resistance.

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F.} \pm 5^{\circ}\text{F.}$  The panels shall show no rusting, blistering or softening when examined after 30 days.

#### Salt Water Resistance.

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at  $75^{\circ}\text{F.} \pm 5^{\circ}\text{F.}$  The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.

#### Weathering Resistance.

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test or panels or blistering.

#### Weathering and Salt Fog Resistance.

Panels shall be tested in the weatherometer as specified above for 300 hours. After this period, the panels shall be removed and scribed with an X of at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting, or blistering beyond 1/16 inch from the center of the scribe mark.

### Resistance to Elevated Temperature and Thermal Shock.

Panels shall be exposed to a temperature of 500°F. for one hour, then quenched immediately in 65°F.  $\pm$  5°F. water. Panels subjected to this test shall show no blistering or flaking of the coating.

3.1.6 Application. The paint shall be capable of being applied to a 3 mil dry film thickness in accordance with specification requirements. The following requirements shall also be met.

- (a) After initial mixing, the paint shall be strained through a metal 30-60 mesh screen.
- (b) Stirring paddles on mechanical mixers shall reach to within 1 inch of the bottom of the stirring container during mechanical mixing.
- (c) Application shall be accomplished with suitable conventional spray or airless spray equipment.

3.1.7 Packaging and labeling. Inorganic zinc paint shall be packaged in a single container. All containers shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of the paint, the lot number, date of manufacture and individual net weights of pigments and vehicle. The container shall be coated if necessary to prevent attack by the paint components.

3.2 Vinyl Paint. The vinyl paint for the finish coat shall be manufactured by the supplier of the inorganic zinc primer. It shall be well ground and shall not be caked, livered, skinned or badly settled in the container. The vinyl paint shall be compatible with and adhere to the cured inorganic zinc primer film, when applied directly over the inorganic zinc paint.

### 3.2.0 Composition.

3.2.1 Vehicle. The vehicle shall consist essentially of vinyl chloride copolymer resins dissolved in aromatic or ketone-aromatic solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

### 3.2.2 Mixed Paint.

- (a) Vinyl paint shall contain not less than 28 percent pigment by weight and 19 percent vehicle solids by weight for a total solids content of not less than 47 percent by weight. The weight per gallon at 77°F. shall be 10.0  $\pm$  1 pounds.
- (b) The vinyl finish coat shall air dry at temperature of 70°F. or above to a hard tough film within four hours, entirely by evaporation of solvents. It shall dry to touch in about 20 minutes at 70°F.

3.2.3 Color. The color of the finish paint shall match the Federal Standard 595 Paint chips as shown in Table No. 1.

TABLE I

COLOR	GREEN	ORANGE	GOLD	BLUE	RUST	ALUM	YELLOW
FED.STAND.NO.	24108	12246	23594	15177	20109	17178	13655

3.2.4 Application. The paint shall be capable of being applied to a 3 mil dry film thickness in accordance with specification requirements. The following requirements shall also be met.

- (a) The inorganic zinc primer shall have dried a minimum of 24 hours under normal conditions and all surfaces should be free of any soluble residue or excessive amounts of loose zinc before the vinyl finish coat is applied.

If the primer is exposed more than 48 hours, dust and dirt, which may have accumulated on the surface, shall be removed from the dried film with a soft brush or rags before application of the finish coat.

- (b) Application shall be accomplished with suitable conventional spray or airless spray equipment. A uniform coating free from runs and sags shall be produced. Brushing may be used for touchup or in areas inaccessible for spraying.
- (c) The vinyl finish coat shall not be applied when the surrounding air temperature is below 40°F. and shall not be applied when the temperature is expected to drop to 32°F. before the paint has time to dry.

3.2.5 Packaging and labeling. Vinyl paint shall be supplied in a single package. All containers shall be approved by the engineer as to type and weight and shall be free of physical defects. All containers shall be cleaned of any paint spilled during filling operations. Vinyl paint shall be packaged in strong substantial 24 gauge or heavier, new metal containers having lug-type replaceable tops. They shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture and net weight of contents.

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3.3 Manufacturer and Brand Name Approval for Inorganic Zinc Paint and Vinyl Paint.

Prior to approval and use of any inorganic zinc, the manufacture shall submit in triplicate to the State Highway Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the State Highway Department of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the State Highway Department when random sampling and testing of material offered for use indicated nonconformance to any of the requirements herein specified.

To obtain final acceptance of inorganic zinc or vinyl paint, the manufacturer shall furnish a certification in triplicate certifying that the materials supplied conform to all the requirements specified, and for the inorganic zinc primer, stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The State Highway Department reserves the right to sample and test any or all materials supplied.

The State Highway Department reserves the right to discontinue approval of products that prove unsatisfactory.

4. CLEANING THE BRIDGE: The contractor shall, at his own expense, sweep clean the bridge floors of each span prior to starting painting operations on that span and keep the bridge floor clean until all work of painting has been completed and accepted for each individual span.

The contractor is cautioned that upon completion of the work and before final acceptance and payment is made, he shall be required to remove all excess paint and foreign matter off the roadway and railing of the bridge and from piers and bents, as directed by the Engineer.

5. MAINTENANCE AND TRAFFIC: The bridge will be kept open to traffic at all times when paint is not being applied to the structure. When paint is being applied, the contractor may, with the approval of the Engineer, close the bridge to traffic, except as noted below, for periods not to exceed ten minutes at a time while paint is actually being applied to the structure. Following each closed period, the bridge shall be opened to traffic and painting operations stopped for a minimum similar period. The contractor shall exert every effort to hold inconvenience to the traveling public to a minimum and shall make use of such flagmen, signs and barricades as the Engineer may direct in the interest of safety and convenience. The use of signs, barricades and flagmen shall be governed by Section 107.10 of the Standard Specifications and the Manual on Uniform Traffic Control Devices published by the U.S. Government printing office.

When cleaning or painting structures over a multilane route, the contractor shall keep at least one lane of traffic open at all times in each direction of travel. Closing of lanes shall be only at times approved by the Engineer.

It will be the contractor's full responsibility to protect the traveling public and adjacent property from flying particles of rust and other foreign matter during the cleaning operation and from flying paint during the painting operation.

6. SURFACE PREPARATION: All steel to be painted shall be cleaned by sand-blasting to meet all the requirements of Steel Structures Painting Council SSPC-SP 6-63 Commercial Blast Cleaning, except that all old paint must be removed.

Sandblasting shall be performed using Ottawa flint silica 20-40 mesh or equivalent and shall produce an anchor pattern with a maximum depth of 2 mils and a dense and uniform pattern of ridges and depressions.

All rust bloom shall be removed by re-blasting before coating and the surface ahead of the coating operation shall be constantly and diligently examined for any traces of rust, oil, grease or other foreign blemishes not permitted by the blasting specifications.

7. WEATHER CONDITIONS AND DRYNESS OF SURFACE: Paint shall not be applied to any surface containing moisture discernible with the eye or by the following test for condensation. If it is suspected that temperature and humidity conditions are such that moisture is condensing upon the surface, the surface shall be moistened with a damp cloth so as to apply a clearly defined thin film of water; if this film evaporates and decreases after 15 minutes, the surface shall be considered safe to paint.

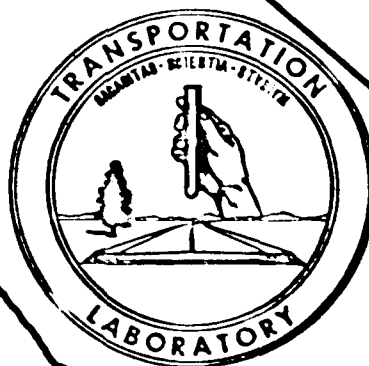
Paint will not be applied when, in the opinion of the Engineer, weather conditions may cause injury to fresh paint.

8. NUMBER AND THICKNESS OF COATS: Metal surfaces of structural steel which have been exposed in accordance with Section 6 of this Special Provision shall have applied one prime coat of inorganic zinc silicate paint and one finish coat of vinyl paint. The thickness of coating for both the primer and finish coats is to be 3 mils dry film thickness. The average total dry film thickness of the two-coat system shall be no less than 5.5 mils.
9. METHOD OF MEASUREMENT AND BASIS OF PAYMENT: Work completed and accepted under this item will be measured and paid for on a lump sum basis for "Painting Existing Steel Bridges with Two-Coat Paint System", which price shall be full compensation for sand-blasting the metal surface, for painting the structure and for all labor, equipment, tools and incidentals necessary to complete the work.



# IMPROVEMENT OF THE PERFORMANCE OF ZINC RICH PRIMER

4 OCT 1978



FINAL REPORT  
JUNE 1978

**Caltrans**  
CALIFORNIA DEPARTMENT OF TRANSPORTATION

Viscosity at 77° F. of the mixed paint shall be between 250 and 650 cps Brookfield, Model RVT, with No. 3 spindle at 100 rpm. The weight per gallon shall be not less than 26.5 pounds at 77° F.

Total solids (residue when heated at 110° C. for 3 hours) shall be not less than 51.0 percent by weight when tested according to Federal Test Method Standard No. 141, Method 401.

The usable pot life of the coating after mixing the components shall be not less than 48 hours at 77° F. There shall be no agglomerates in the mixed paint and no hard settling which cannot be easily redispersed.

#### Properties of Cured Coating:

Resistance to cracking and flaking shall be such that the coating, when applied to a dry film thickness of seven mils at 70° F. to 80° F. at 65 to 70 percent relative humidity in still air (no air movement over the surface), shall not develop cracking or flaking.

Pencil hardness of the coating, when applied to a dry film thickness of four mils with 24 hours drying time at 70° F. to 80° F. and at 65-70 percent relative humidity in still air, shall be not less than 5H.

#### Packaging and Labeling:

The label of the containers shall show the State Specification number, the manufacturer's name, lot or batch number, date of manufacture, date of packaging, and date, if any, beyond which the paint must not be used without additional testing and approval.

The paint shall be packaged so that one unit of the pigment can be mixed with the vehicle in its container.

Each container must be marked in large type with a warning against resoling any container after the paint is mixed. Complete instructions for use shall be included with each container of paint. The lining of the vehicle containers shall be of such type as to prevent attack of the container.

#### 91-2-02 Self-Cure Zinc Silicate Paint—Poly-Organo Siloxane Vehicle (State Specification 681-80-56) —

#### Description:

The zinc silicate paints shall be a 2-component self-curing type which when mixed and applied in accordance with specification requirements shall cure without the use of a separate curing solution to a coating having the properties described herein.

#### Composition:

##### Poly-Organo Siloxane Vehicle

#### Pigment Ingredients

The pigment shall consist of a finely divided zinc powder containing a minimum of 95 percent metallic zinc and 5 percent total zinc by weight using Federal Test Method Standard No. 143, Method 7221, and having an average particle size not exceeding 5.5 microns as determined by the Fisher Sub-Sieve Sizer. The zinc powder shall have a specific gravity of 7.00 to 7.14 as determined using the procedure set forth in ASTM Designation: D 153.

#### Vehicle Ingredients

Pyrazolone red, dry pigment shall be dispersed in the vehicle at the rate of 0.5 percent of the weight of the vehicle. It shall be so dispersed as to yield a grind of 6 Hfgman, minimum. The vehicle without pigment shall have the following composition:

	Percent by Weight
Ethyl Silicate, 40% SiO <sub>2</sub> content, to correspond to the resin used in Federal Specification MIL-P-15325	21.7
Secondary Butyl Alcohol	6.5
Cyclohexanone	47.1
1, 1, 2-Trichloroethane	6.4
2-Nitro Propane	5.5
Diocetyl Sodium Sulfosuccinate, 10% solution in secondary Butyl Alcohol or a 75% solution in distilled water	0.6
Hydrochloric Acid, 0.25% solution of Hydrogen Chloride Gas	0.4
	2.9

#### Vehicle Properties:

Non-volatile at 105° C., percent by weight	28.0 - 25.0
Viscosity, Brookfield, Model RVT, No. 1 spindle at 60 rpm, poises	0.85 - 1.50
Flash point, Tag Closed Cup, °F., minimum	69
Weight per gallon, pounds, at 77° F.	7.6 - 7.8
Sulfon dioxide equivalent, percent by weight, minimum	11.2
Storage life at 77° F., month, minimum	6
Viscosity at 77° F. after 72 hours at 140° F., Brookfield, Model RVT, No. 1 spindle at 60 rpm, poises	1.85 max.

#### Mixed Paint Properties:

The zinc dust shall be mixed with the vehicle in the ratio of 13.5 pounds per gallon of vehicle just before use. The mixed paint shall have the following properties:

Weight per gallon at 77° F., pounds, minimum	17.2
Viscosity, KU at 77° F.	70-80
Viscosity, KU at 77° F. after 24 hours, maximum	80
Non-volatile at 105° C., percent by weight, minimum	72.0
Dry time at 77° F., and 60% relative humidity, 6 mil wet film thickness:	
Set to touch, hours, maximum	1
Dry hard, hours, maximum	2

**Properties of Cured Coating:**

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by sandblasting to produce a cue to 1 1/2 mil anchor pattern, and cured for 15 days at a relative humidity of 50 ± 5%, the coating shall have the following properties:

Panel hardness, minimum	4H
Flexibility and Adhesion, Council Standard Test, Federal Test Method Standard No. 141, Method C-222, elongation, percent	10
Wet film	
There shall be no loosening of the film above the point of the fastest continuous crack.	
Salt Stress Fog Test—When a steel panel is sandblasted to white metal and coated with 3-4 mils dry film thickness of this coating and cured for 5 days and diagonally bent to expose bare steel, there shall be no corrosion on the surface of the coated steel after 1,000 hours when tested according to ASTM D-117.	

**Packaging and Labeling:**

The label of the containers shall show the State Specification number, the manufacturer's name, lot or batch number, date of manufacture, date of packaging, and date, if any, beyond which the paint must not be used without additional testing and approval.

The paint shall be packaged so that one unit of the pigment can be mixed with the vehicle in its container.

The label shall state that containers of unused material must be kept tightly sealed, and the paint must be used within 12 hours from the time it was mixed when the temperature does not exceed 77° F.; between 77° F. and 90° F. the paint shall be used within 6 hours and at temperatures above 90° F. it shall be used within 4 hours. The pigment shall not show more than slight soft settling after 6 hours from the time of mixing. Complete instructions for use shall be included with each container of paint. The lining of the vehicle containers shall be of such type as to prevent attack of the container.

**91-2.03 Paint, Primer, Red Lead, Semi-Quick Drying (State Specification 681-80-53).—**

**Classification:**

This specification covers a ready-mixed priming paint for use on structural steel where rapid drying is required. It combines the desirable characteristics of the straight oil primers with those of the synthetic resins. It is recommended for general use in locations where the wet paint film is subject to early contamination.

When this paint is used for second coat, 0.25 pound lampblack, Federal Specification TYP-P-350, per gallon of paint shall be added.

**Composition:**

Pigment Ingredients		Lbs./100 Gals.
Red Lead (97 percent Grade)	Specifications	
Aluminum Bicarbonate	TT-P-1391, Type 1	165
Diatomaceous Silica	MTL-A-15268	6
	MTL-S-15191	25

Vehicle Ingredients		Lbs./100 Gals.
Linseed Oil (Raw)	TT-P-215	
Alkyd Resin Solution	681-80-130	150
Thinner	TT-T-291, Grade 1	307
Driers	TT-D-613	114

**Characteristics:**

Weight per gallon, in pounds	21.7 max.
Pigment by weight of paint, percent	73.5 max.
Volatiles by weight of paint, percent	12.1 max.
Viscosity, KU	62-85
Drying time: set to touch, hours	4 max.
set for recoating, hours	16 max.
Water, percent	10 max.
Fineness of grind, Hegman	0.5 max.
Plasticity, adjustable, by weight of non-volatile vehicle, percent	4 min.
There shall be no objectionable odor.	10 min.
Working properties shall be satisfactory.	

**91-2.04 (Blank)**

**91-2.05 Zinc Chromate Primer for Metal (State Specification 681-80-51).—**

**Classification:**

This specification covers a ready-mixed fast drying primer for use on aluminum, galvanized surfaces, or blast-cleaned steel surfaces, all of which have been first coated with Pre-Treatment Vinyl Wash Primer (State Specification 681-60-52).

**Composition:**

Pigment Ingredients		Lbs./100 Gals.
	Specifications	
Zinc Yellow	TT-P-465, Type 1	405
Zinc Oxide	TT-P-463, Type 1, Grade A	60
Silica	TT-P-413	25
Magnesium Silicate	TT-P-463	30
Aluminum Stearate	MTL-A-15266	6
Vehicle Ingredients		
Allyl Resin Solution	651-80-130	485
Thinner	TT-T-201, Grade 1	133
Driers	TT-D-613	

Vehicle Ingredients		
Alkyd Resin Solution	681-60-130	485
Thinner	TT-T-291, Grade 1	133
Driers	TT-D-613	
		<hr/> 1162

This paint is not for use on metal surfaces which cannot be prepared as outlined.

This paint is not for use on metal surfaces which cannot be prepared as outlined.

# DOCUMENT CONCRETE

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## SECTION 91

### SECTION 91

#### PAINT

##### 91-1 MATERIALS

**91-1.01 Description.**—These specifications are intended to specify paints that will meet service requirements for highway construction.

Paint shall be homogeneous, free of contaminant and of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such nature that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paints the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing.

Attention is directed to Section 7-1.01K, "Air Pollution Control."

**91-1.02 Sampling and Testing.**—Unless otherwise permitted by the Engineer, paint shall be sampled at the place of manufacture and tested by the Engineer and application will not be permitted until the paint has been approved by the Engineer.

An unopened container of each batch of finished paint shall be furnished to the Engineer at the job site for testing. Check samples of finished paint as being applied will be taken at intervals as determined by the Engineer.

All tests will be conducted in accordance with the latest test methods of the American Society for Testing and Materials, Federal Test Method Standard No. 141, and methods in use by the Transportation Laboratory.

**91-1.03 Manufacturing and Packaging.**—All manufactured paint shall be prepared at the factory ready for application. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted, unless so specified.

The finished paint shall be furnished in new, round steel containers of not more than 6-gallon capacity and of metal not thinner than 0.024-inch nominal thickness. The containers shall have lug type crimp lids with ring seals and be equipped with ears and bails. The containers shall meet U.S. Department of Transportation Hazardous Material Shipping Regulations. The container shall be lined if necessary to prevent attack by the paint. The lining shall not come off the can as skins.

No finished paint shall be used until at least 7 days have elapsed from the date of its manufacture.

All containers of paint shall be labeled showing the exact title of the paint specification, State specification number, manufacturer's name, date of manufacture, State lot number, and manufacturer's batch number.

Precautions concerning the handling and the application of paint shall be shown on the label of paint and solvent containers in accordance with the Construction and General Industry Safety Orders of the Division of Industrial Safety, Department of Industrial Relations, of the State of California.

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PAINT

91-1.04 Materials.—The raw materials for use in the various paint formulas shall conform to the specifications designated by Federal or Military serial number or paint material code number under the various paint classifications hereinafter specified. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.

### 91-2 PAINTS FOR METAL

#### 91-2.01 Zinc-Rich Primer, Organic Vehicle Type (State Specification 741-5062).—

##### Description:

This specification covers a one-package, thermoplastic organic zinc-rich primer whose mechanism of drying is that of solvent release. It is intended for use only on blast cleaned open steel structures exposed to the air.

This coating is intended for spray application. Limited application can be made by brushing.

##### Composition:

Pigment Ingredients (62.3 Percent of Composition Weight, Minimum)			
	Specification	Parts by Weight of Pigment	
		Type I, Red Tint	Type II, Gray
Zinc Dust .....	TT-P-460, Type I <sup>1</sup>	95.0 min	95.0 min
Red Iron Oxide <sup>2</sup> .....	—	1.5 max	—
Zinc Oxide .....	TT-P-463, Type I, Grades A or B	—	1.5 max
Thixotropes and Additives .....	—	3.5 max	3.5 max

Vehicle Ingredients (37.7 Percent of Composition Weight, Maximum)		
	Specifications	Parts by Weight of Vehicle
Polysyl Ether <sup>3</sup> .....	—	19.0
Ethylene Glycol Monoethyl Ether Acetate .....	MIL-E-7125	66.8
Toluene .....	TT-T-548	14.2

<sup>1</sup> Except the metallic zinc content shall be 95 percent by weight, minimum.

<sup>2</sup> Fe<sub>2</sub>O<sub>3</sub> 94.5% minimum, oil absorption, 21, fineness through 325 mesh screen, 99% minimum, and specific gravity, 5.15.

<sup>3</sup> A polyhydrous polyalkaryl polyether of the following properties:

Specific Gravity .....	1.18
Viscosity of 40% solids in methyl ethyl ketone, Brookfield	
RVF, 20 rpm No. 5 spindle .....	5,500 to 7,700 cps
Reduced viscosity (0.2 g/100 ml dimethylformamide) .....	0.4 to 0.6
Ultimate tensile strength .....	9,000 to 9,500 psi
Ultimate tensile elongation .....	50 to 100%
Softening temperature .....	215° F
Bulking value .....	9.83 lbs per gal

PAINT

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in the various paint formulas shall be the Military serial number or other classifications hereinafter mentioned. Substitutions for any specified materials shall be approved by the Engineer.

AL

Type (State Specification 741-80.

plastic organic zinc-rich primer base. It is intended for use only on the air. Limited application can be made

ht, Minimum)

Parts by Weight of Pigment	
Type I, Red Tint	Type II, Gray
95.0 min.	95.0 min.
1.5 max.	1.5 max.
3.5 max.	3.5 max.

ht, Minimum)

Specifications	Parts by Weight of Vehicle
MIL-I-7125	19.0
TT-T-548	66.8
	14.2

minimum mesh screen, 99% minimum and specific

118	5,500 to 7,700 cps
	0.4 to 0.6
	9,000 to 9,500 psi
	50 to 100%
	212° F
	9.50 lbs. per gal

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The average particle size of the pigment shall not exceed 9 microns as determined by the Fisher Sub-Sieve Sizer. The Red Iron Oxide must first be ground into a portion of the vehicle to provide a Hegman grind sufficient to produce the specified color of the finished paint.

The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

### Infrared Characteristic Curve of Primer Vehicle:

When dried upon a potassium bromide disc, a film of the primer shall have infrared absorption maximums at the same wavelengths and to the same relative degree as that shown by the curve on file in the Transportation Laboratory.

The composition of the extracted zinc dust pigment shall match the X-ray diffraction curve on file at the Transportation Laboratory.

The paint shall in addition to the preceding composition conform to the following table of requirements:

### Characteristics of Paint:

Volatiles at 105° C., percent by weight	28-32
Weight per gallon, pounds	17.2-18.0
Viscosity, KU at 77° F.	100-120
Metallic zinc, percent by weight of extracted pigment by Federal Test Method No. 141, Method 7221	90.2 min
Dry time at 77° F., 50% relative humidity, 6 mil wet thickness	
Set to touch, hours	3/4 max
Dry hard, hours	5 max
Storage life, years	1 min

### Properties of Cured Coating:

When applied to a plate glass panel with a 6 mil gap clearance doctor blade and cured for 15 days at 77° ± 5° F. and 50 ± 5% relative humidity, the coating shall have the following properties:

Pencil Hardness	B min
Color (for Type I only)	Not Lighter Than Standard Color Chip No. 42 (State Specification 691-80 450)

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on blast cleaned steel having an anchor profile pattern of one to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by blast cleaning to produce a one to 1.5 mil anchor pattern, and cured for 15 days at a relative humidity of 50 ± 5% and tested according to the Conical Mandril Test, Federal Test Method Standard No. 141, Method 6222, there shall be no loosening of the film above the point of the longest continuous crack.

When a steel panel is blast cleaned to white metal and coated with 3-4 mils dry film thickness of this coating and cured for 15 days at 75° ± 2° F. and 50 ± 5% relative humidity and diagonally scribed to expose bare steel, there shall be no underfilm corrosion on the surface of the panel extending beyond the scribed lines after 1,000 hours when tested according to ASTM Designation: B 117.

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PAINT

Prior to use, the paint shall be thinned with not more than one volume thinner to 4 volumes of paint using a power agitated stirrer. The thinner shall consist of a mixture of 82 percent by volume of ethylene glycol monoethyl ether acetate and 18 percent by volume of toluene.

91-2.02 (Blank)

91-2.03 (Blank)

91-2.04 (Blank)

91-2.05 (Blank)

91-2.06 Aluminum Vehicle (State Specification 651-50-404).—

### Classification:

This specification covers an aluminum vehicle clear varnish and general purpose phenolic base spar mixing varnish. This varnish should not be used on surfaces and in pigment combinations where yellowing will be objectionable.

### Composition:

This vehicle shall be an oil varnish, the resinous portion of which shall be a phenol-formaldehyde type. The resin shall correspond to Military Specification MIL-R-15189. The varnish shall be 33 gallons in oil length, 30 gallons of which shall be Tung Oil, Federal Specification TT-T-775 and 3 gallons shall be Alkali Refined Linseed Oil, Federal Specification TT-L-1155.

The volatile portion of this varnish, which shall not exceed 50 percent of the total weight of the varnish, shall consist of 90 percent Mineral Spirits, Federal Specification TT-T-291E, Type II, Grade A and 10 percent ethyl benzene. The driers shall consist of the naphthenates of lead, cobalt, and manganese in such proportion as required. Based on oil content, the following maximum limits shall apply: Lead 0.3%, Cobalt 0.03%, Manganese 0.015%.

### Characteristics:

Weight per gallon, in pounds .....	7.4-7.6
Clear, transparent, and homogeneous non-volatile, percent by weight .....	50-55
Viscosity, Gardner-Holdt .....	10-15
Dry through, hours .....	18 max
Kaum reduction, percent .....	140
Flash point, ° F. ....	86 min
Zinc Oxide reactivity .....	none
Skinning After 48 hours in 3/4 full closed container .....	none
Rosin content, (Lieberman-Storch) .....	none
Flow, spray, brush, leveling properties .....	excellent
Gas test, Federal Test Method 4161 .....	pass

### Flow out films on test tubes:

After having dried 96 hours at 60° F. to 77° F. shall:

1. Withstand boiling water for 7 hours without dulling, checking, or whitening.
2. Show no deviation in properties after 18 hours immersion in water at 77° F. and subsequent drying for 2 hours.
3. Withstand 0.1N sulfuric acid for 24 hours at 77° F. without dulling, checking, or whitening.
4. Withstand 5 percent Sodium Hydroxide solution for 6 hours at 77° F. without dulling, checking, or whitening.

## 91-2.07 Pre-Treat

### Classification:

This specification is for painting prior to painting coated with an oil cleaned steel wheel systems

### Composition:

Polysynyl butyral resin  
Zinc Chromate (ins)  
Magnesium silicate  
Lampblack  
Butyl Alcohol, norm  
Ethyl Alcohol

Phosphoric Acid, 85%  
Water  
Ethyl Alcohol

\* The polysynyl part  
acetate in the mix  
Polysynyl a  
Polysynyl a  
Inherent v  
Specific gr  
Heating to  
Ash, percent

\* The zinc chromate  
72 percent ZnO  
\* Isopropyl alcohol  
The isopropyl alcohol  
than 15°C and

### Characterist

Pigment, percent  
Volatiles, percent  
Non-volatile ve  
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Ratio of pigme  
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## PAINT

more than one volume of  
drier. The thinner shall  
be ethylene glycol monoethyl  
ether.

351-50-404).—

clear varnish and general all  
varnish should not be used on  
fading will be objectionable.

is portion of which shall be a  
pond to Military Specification  
oil length, 30 gallons of which  
5 and 3 gallons shall be Alkali  
-1155.

not exceed 50 percent of the  
recent Mineral Spirits, Federal  
0 percent ethyl benzene. The  
cobalt, and manganese in such  
following maximum limits shall  
15%.

.....	7 4-7 6
..... by	
.....	50-55
.....	B-D
.....	18 max.
.....	140
.....	66 min.
.....	none
.....	none
.....	none
.....	excellent
.....	pass

7° F. shall:  
out dulling, checking, or whit-

5 hours immersion in water at  
77° F. without dulling.

le solution for 6 hours at 77° F.  
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## PAINT

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### 91-2.07 Pre-Treatment, Vinyl Wash Primer (State Specification 701-60.52).—

#### Classification:

This specification covers a wash primer formulated specifically for application  
prior to painting clean aluminum, galvanized surfaces or surfaces previously  
coated with an organic or inorganic zinc-rich primer. It is also used on blast  
cleaned steel when specified and is mandatory as an undercoat under vinyl paint  
systems.

#### Composition:

Resin Component	
Specifications	Pounds per 80 gallons of Resin Component
Polyvinyl-butylal resin <sup>1</sup> .....	56
Zinc Chromate (insoluble type) <sup>2</sup> .....	54
Magnesium-silicate..... (Type A or B MIL-M-15173).....	8
Lampblack..... (TT-P-350).....	0 6
Butyl Alcohol, normal..... (TT-B-846).....	125
Ethyl Alcohol..... (Grade III of O-E-760) <sup>3</sup> .....	380

#### Acid Component

	Pounds per 20 gallons of Acid Component
Phosphoric Acid, 85%..... (Class 1 of O-O-670).....	25
Water.....	25 max
Ethyl Alcohol..... (Grade III of O-E-760) <sup>3</sup> .....	102

<sup>1</sup> The polyvinyl partial butylal resin shall contain only polyvinyl butylal, polyvinyl alcohol and polyvinyl  
acetate in the molecule, and shall have the following properties

Polyvinyl alcohol, percent by weight.....	19.0-22.0
Polyvinyl acetate, percent by weight.....	1.0 max
Inherent viscosity, ASTM Designation D 1243.....	0.87-0.95
Specific gravity.....	1.10-1.14
Heating loss, 45 minutes at 105° C., percent by weight.....	3.0 max
Ash, percent by weight.....	0.1 max

<sup>2</sup> The zinc chromate shall be of an insoluble type, showing an analysis 16 to 19 percent CrO<sub>3</sub>, and 67 to  
72 percent ZnO, and not more than one percent water soluble salts

<sup>3</sup> Isopropyl alcohol (99 percent) may be substituted in part for ethyl alcohol on an equal volume basis.  
The isopropyl alcohol shall have a specific gravity of 0.785 to 0.790 and a distillation range not greater  
than 15° C., and this range shall include 82.3° C.

#### Characteristics of Resin Component:

	Minimum	Maximum
Pigment, percent by weight.....	95	105
Volatiles, percent by weight.....	80 0	82 0
Non-volatile vehicle, percent by weight (Calculated by difference).....	83	93
Ratio of pigment to non-volatile vehicle by weight.....	97 to 9	103 to 9
Coarse particles and skins, as residue retained on standard No 325 mesh sieve (RR-S-366), per- cent by weight.....	—	05



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Viscosity, Krebs units	57	6
Weight per gallon, pounds	7.2	7.2
Fineness of grind	5	—
Chromium oxide (CrO <sub>3</sub> ), percent by weight of pigment	14	—
Zinc oxide (ZnO), percent by weight of pigment	57	—
Distillation		
Initial boiling point, °C	75	82
Temperature at 80 ml point, °C	—	85
Temperature at 100 ml point, °C	116	—
End point, temperature, °C	—	120
Volume at end point, ml	112	—

### Characteristics of Acid Component:

Phosphoric acid, percent by weight	15.0	16.5
Distillation		
Initial boiling point, °C	75	81
Temperature at 105 ml point, °C	—	82
Volume at end point, ml	120	—
Maximum temperature during distillation, °C	—	102
Weight per gallon, pounds	7.5	7.9

### Characteristics of Mixed Resin and Acid Components:

Dry time, hard—minutes 30 max  
Smooth homogeneous mix, no gelation within 24 hours in closed container.

### Packaging and Labeling:

The label shall state that the primer is to be packaged such that the acid component can be mixed with the resin component in the resin component container. The resin and acid components shall be separately packaged, and the packages shall be of such type as to prevent attack by the components.

The label shall also state that one part by volume of the acid component is to be added slowly with constant stirring to 4 parts by volume of the resin component just before use and that the mixed components must be used within 8 hours. It shall further state that the mixed material is intended for spray application in dry film thicknesses of 0.3- to 0.5-mil.

### 91-2.05 Aluminum Paint, Finish Coat (State Specification 681-80-50).—

#### Classification:

This specification covers a phenolic resin varnish base aluminum paint, suitable for use as a finish coat. It is formulated for use on structural steel and interior and underwater surfaces of steel water tanks and similar exposed surfaces.

This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

#### Composition:

The composition of the paint shall be 2.0 pounds of aluminum paste to one gallon of vehicle.

Aluminum Paste: Federal Specification TT-P-320 Type II, Class 2 leafing type (except that the non-volatile shall be 74 percent minimum).

Aluminum Vehicle: State Specification 681-80-404.

## PAINT

When specified Federal Specification type

Characteristics:  
Drying time

91-2.09 Enamel

Classification:

This specification is for use on metal surfaces.

This paint is formulated in accordance with regulations in 1115A, and in 1115B.

91-2.10 Vinyl

Classification:

This specification is for properly prepared, vinyl applied alternate type (State Specification 741-10) is formulated in accordance with regulations in 1115A, and in 1115B.

Composition

Red Iron Oxide  
Magnesium Silicate

Vinyl Resin  
Vinyl Resin  
Toluene  
Normal Butyl  
Di (2-ethylhexyl)  
Soda Lauryl Sulfate  
Epoxy Resin  
Methyl Norm

1.0 g. 95.5%  
specific gravity  
A vinyl chloro  
vinyl acetate  
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0.5% paste of  
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# PAINT

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When specified for first coat work, the Aluminum Paste shall conform to Federal Specification TT-P-320 Type II, Class 2, except it shall be a non-leafing type.

### Characteristics:

Drying time: set to touch, hours..... 3 max  
dry through, hours..... 16 max

### 91-2.09 Enamel; Exterior White, Metal (State Specification 741-50-10).—

#### Classification:

This specification covers a fast drying exterior white enamel, primarily for use on metal, or for other exterior surfaces where gloss and durability are requisite.

This paint shall conform to the provisions of Military Specification MIL-E-1115A, and in addition, shall comply with all air pollution control rules and regulations in the State of California in effect at the time the paint is applied.

### 91-2.10 Vinyl Primer, Red Iron Oxide Type (State Specification 741-50-40).—

#### Classification:

This specification covers a ready-mixed vinyl-red iron oxide paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52). This paint should be applied alternately with Vinyl Primer, Red Iron Oxide—Titanium Dioxide Type (State Specification 741-80-41) to provide a primer coating which may consist of one or more applications of each vinyl primer. Either State Specification 741-80-40 or 741-80-41 may be used for the initial application. This paint is formulated primarily for spray application.

#### Composition:

Pigment Ingredients			
	Specifications	Type I Lbs/100 Gals	Type II Lbs/100 Gals
Red Iron Oxide <sup>1</sup>		51.2	45.0
Magnesium Silicate	TT-P-403	7.2	6.8
Vehicle Ingredients			
Vinyl Resin <sup>2</sup>		87.2	82.0
Vinyl Resin <sup>3</sup>		28.8	27.0
Toluene	TT-T-548	109	76.3
Normal Butyl Acetate	TT-B-838	500	—
Di-(2-ethylhexyl) Phthalate		28.8	27.0
Soya Lecithin		7.2	6.8
Epoxy Resin <sup>4</sup>		0.6	0.6
Methyl Normal Butyl Ketone		—	493

<sup>1</sup> Fe<sub>2</sub>O<sub>3</sub>, 98.5% minimum, oil absorption, 21, fineness through 325 mesh screen, 99% minimum, and specific gravity, 5.15

<sup>2</sup> A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of 0.57 poise at 20° C. in cyclohexanone

<sup>3</sup> A vinyl chloride-vinyl acetate copolymer resin, specific gravity, 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.53 poise at 20° C. in cyclohexanone

<sup>4</sup> A vinyl chloride-vinyl acetate copolymer resin with a specific gravity of 1.36, vinyl chloride content of approximately 84%, vinyl acetate content of approximately 16%, inherent viscosity (ASTM Designation D 1243) of 0.49-0.51.

## SECTION 91

## PAINT

- <sup>a</sup> A vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.1, inherent viscosity (ASTM Designation D 1243) of 0.31-0.32
- <sup>b</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.36
- <sup>c</sup> A carboxyl-modified vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.33
- <sup>d</sup> Liquid, color 5 max. (Gardner), 100-180 poise viscosity at 25° C., 180-195 epoxide equivalent

The preparation of this paint in steel ball mills is not acceptable.

### Characteristics:

	Type I	Type II
Toluene and Isoketones by volume of volatiles, percent	19.0 max	19.0 max
Weight per gallon, in pounds	8.0- 8.4	7.5- 7.9
Pigment by weight of paint, percent	6.4- 8.1	6.3- 8.0
Volatiles by weight of paint, percent	73.3-75.3	73.2-75.2
Fineness of grind, Hegman	6 min	6 min
Viscosity, KU	61 max	61 max
Drying time: set to touch, hours	½ max	½ max

The components of this paint shall be ground and mixed in a manner which will insure adequate wetting and suspension of the pigment.

Working properties shall be satisfactory.

Carbon respirators, maintained according to the manufacturer's recommendations, shall be used when Type II vinyl paints are applied.

NOTE: If vinyl resin 2 is used, vinyl resin 3 shall be used. If vinyl resin 2a is used, vinyl resin 3a shall be used. If vinyl resin 2b is used, vinyl resin 3b shall be used.

Types I or II may be used at the option of the Contractor, providing he uses the same type in Sections 91-2.10, 91-2.11, 91-2.12, 91-2.13, 91-2.22 and 91-2.23

### 91-2.11 Vinyl Primer, Red Iron Oxide—Titanium Dioxide Type (State Specification 741-80-41).—

#### Classification:

This specification covers a ready-mixed, vinyl-red iron oxide-titanium dioxide paint, for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52). This paint is formulated primarily for use on steel structures which are located in the coastal zone. This paint should be applied alternately with Vinyl Primer, Red Iron Oxide Type (State Specification 741-80-40) to provide a primer coating which may consist of one or more applications of each vinyl primer. Either State Specification 741-80-40 or 741-80-41 may be used for the initial application. This paint is formulated primarily for spray application.

#### Composition:

Pigment Ingredients		
Specifications	Type I Lbs/100 Gals	Type II Lbs/100 Gals
Red Iron Oxide <sup>1</sup>	19.2	18.0
Titanium Dioxide	39.2	37.0
Vehicle Ingredients		
Vinyl Resin <sup>2a</sup>	87.2	82.0 <sup>b</sup>
Vinyl Resin <sup>2b</sup>	28.8	27.0 <sup>b</sup>

## PAINT

Toluene  
Normal Butyl Acetate  
Di-(2-ethylhexyl) Phthalate  
Soya Lecithin  
Epoxy Resin  
Methyl Normal Butyl Ket

- <sup>1</sup> Fe<sub>2</sub>O<sub>3</sub>, 99.5% minimum, 99.5% specific gravity, 8.15
- <sup>2</sup> A vinyl chloride-vinyl acetate copolymer, and 6% vinyl acetate, and 1% into 0.51 poise at 25° C in cool
- <sup>3</sup> A vinyl chloride-vinyl acetate copolymer, approximately 84% vinyl acetate, and 1% into 0.51 poise at 25° C in cool
- <sup>4</sup> A vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer, inherent viscosity (ASTM Designation D 1243) of 0.4-0.51
- <sup>5</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.36
- <sup>6</sup> Liquid, color 5 max. (Gardner), 100-180 poise viscosity at 25° C., 180-195 epoxide equivalent

### The preparation of Characteristics:

Toluene and Isoketone  
Weight per gallon, in p  
Pigment by weight of p  
Volatiles by weight of p  
Fineness of grind, Heg  
Viscosity, KU  
Drying time: set to tou

The components of  
insure adequate wet  
Working property

Carbon respirators  
tions, shall be used v

NOTE: If vinyl resin 2 is  
be used, If vinyl  
Types I or II  
in Sections 91-2

### 91-2.12 Vinyl Pai Classification:

This specifica  
prepared metal  
Wash Primer (C  
This paint is pr  
This paint sh  
mixed fresh cat

## PAINT

specific gravity of 1.31.

A Designation

ASTM Designation D

to equivalent

acceptable.

### Type II

1	19.0 max
4	7.5-7.9
1	6.3-8.0
3	73.2-75.2
1	6 min
1	61 max
1	1/2 max

manner which will

er's recommenda-

ed, vinyl resin 3a shall

he uses the same type

ype (State Specifici-

side- num diox-  
have been  
ification 701-S0-  
structures which are  
nately with Vinyl  
3-40) to provide a  
tions of each vinyl  
ay be used for the  
pray application.

als	Type II Lbs/100 Gals
	18.0
	37.0
	82.0
	27.0

## PAINT

Toluene	TT-T-548	100	78.3
Normal Butyl Acetate	TT-B-838	404	—
Di-(2-ethylhexyl) Phthalate		28.8	27.0
Soya Lecithin		7.2	6.8
Epoxy Resin *		0.6	0.6
Methyl Normal Butyl Ketone		—	403

\* Fe<sub>2</sub>O<sub>3</sub>, 98.5% minimum, oil absorption, 21, fineness through 325 mesh screen, 99% minimum, and specific gravity, 5.15

<sup>1</sup> A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate, and 6% vinyl alcohol with an intrinsic viscosity of 0.57 poise at 20° C. in Cyclohexanone

<sup>2</sup> A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.35, containing 86% vinyl chloride, 13% vinyl acetate, and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.53 poise at 20° C. in cyclohexanone

<sup>3</sup> A vinyl chloride-vinyl acetate copolymer resin with a specific gravity of 1.36, vinyl chloride content of approximately 84%, vinyl acetate content of approximately 16%, inherent viscosity (ASTM Designation D 1243) of 0.49-0.51

<sup>4</sup> A vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.31, inherent viscosity (ASTM Designation D 1243) of 0.31-0.32

<sup>5</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity, 1.36

<sup>6</sup> A carboxyl modified vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.33

\* Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25° C., 180-195 epoxide equivalent

The preparation of this paint in steel ball mills is not acceptable.

### Characteristics:

	Type I	Type II
Toluene and Isoketones by volume of volatiles, percent	19.0 max.	19.0 max.
Weight per gallon, in pounds	8.0-8.4	7.5-7.9
Pigment by weight of paint, percent	6.4-8.1	6.3-8.0
Volatiles by weight of paint, percent	73.2-75.2	73.2-75.2
Fineness of grind, Hegman	6 min.	6 min.
Viscosity, KU	61 max.	61 max.
Drying time, set to touch, hours	1/2 max.	1/2 max.

The components of this paint shall be ground and mixed in a manner which will insure adequate wetting and suspension of the pigment.

Working properties shall be satisfactory.

Carbon respirators, maintained according to the manufacturer's recommendations, shall be used when Type II vinyl paints are applied.

NOTE If vinyl resin 2 is used, vinyl resin 3 shall be used. If vinyl resin 2a is used, vinyl resin 3a shall be used. If vinyl resin 2b is used, vinyl resin 3b shall be used.

Types I or II may be used at the option of the Contractor, providing he uses the same type in Sections 91-2.10, 91-2.11, 91-2.12, 91-2.13, 91-2.22 and 91-2.23

### 91-2.12 Vinyl Paint, Aluminum Finish Coat (State Specification 741-S0-49).—

#### Classification:

This specification covers a vinyl type aluminum paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Specification 701-S0-52), or specified vinyl undercoats. This paint is primarily formulated for spray application.

This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

## SECTION 91

### Composition:

#### Pigment Ingredients Specifications

Aluminum powder ..... TT-P-320, Type I, Class 2, (leafing)

To be separately packaged in multiples of 0.54 pound of powder per gallon of vehicle. One 2.70 pound container for each 5-gallon can of vehicle.

#### Vehicle Ingredients

Specifications	Type I Lbs 100 Gals	Type II Lbs 100 Gals
Vinyl Resin <sup>1a</sup>	62.4	62.4
Vinyl Resin <sup>1b</sup>	62.4	62.4
Toluene ..... TT-T-548	110	74.1
Normal Butyl Acetate ..... TT-B-838	507	—
Di-(2-ethylhexyl) Phthalate	31.7	32.3
Epoxy Resin <sup>2</sup>	0.6	0.6
Methyl Normal Butyl Ketone	—	49.5

<sup>1a</sup> A vinyl chloride/vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 7% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of 0.57 poise at 20° C. in cyclohexanone.

<sup>1b</sup> A vinyl chloride/vinyl acetate copolymer resin, specific gravity 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.53 poise at 20° C. in cyclohexanone.

<sup>2</sup> A vinyl chloride/vinyl acetate copolymer resin with a specific gravity of 1.36, vinyl chloride content approximately 84%, vinyl acetate content of approximately 16%, inherent viscosity (ASTM Designation D 1243) of 0.49-0.51.

<sup>3</sup> A vinyl chloride/maleate diester-unsaturated carbonic acid terpolymer with a specific gravity of 1.21, inherent viscosity (ASTM Designation D 1243) of 0.31-0.32.

<sup>4</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.36.

<sup>5</sup> A carboxyl modified vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.33.

<sup>6</sup> Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25° C., 180-195 epoxide equivalent.

### Characteristics of Vehicle:

	Type I	Type II
Toluene and Isoketone by volume of volatiles, percent	19.0 max	19.1 max
Weight per gallon, in pounds	7.5-7.9	7.4-7.5
Volatiles by weight of paint, percent	78.7-80.7	77.2-79.2
Viscosity, KU	61 max	61 max
Drying time - set to touch, hours	1/2 max	1/2 max

Working properties shall be satisfactory.

The label on each container shall bear the legend "For spray application only, not suitable for brush application."

Carbon respirators, maintained according to the manufacturer's recommendations, shall be used when Type II vinyl paints are applied.

NOTE: If vinyl resin 1 is used, vinyl resin 2 shall be used. If vinyl resin 1a is used, vinyl resin 2a shall be used. If vinyl resin 1b is used, vinyl resin 2b shall be used.

Types I or II may be used at the option of the Contractor, providing he uses the same type in Sections 91-2.10, 91-2.11, 91-2.12, 91-2.15, 91-2.22 and 91-2.23.

91-2.13 (Blank)

91-2.14 Burnt Umber Tint Finish Coat (State Specification 741-80-76).—

## PAINT

## PAINT

### Classification

This specification may be applied

### Composition

Titanium Dioxide

Yellow Iron Oxide  
Burnt Umber

Alkyd Resin Solution

Mineral Spirits

Driers

Yellow Oxide (DegOx)

Yellow Oxide (DegOx)

This quantity based on

Color of pigment raw

State Specification 601

An anti settling agent,

making of the pigment

### Characteristics:

Weight per gal

Pigment by w

Volatiles by w

Viscosity, KU

Drying time

Fineness of gr

Skimming No

Color To ma

There shall b

Working prop

Viscosity ran

91-2.15 Vinyl

Classification

This spec

properly p

ment, Vin

undercoat

Composition

Titanium Dioxide

Phthalocyanine

Chrome Oxide

## PAINT

(2, deafer)

powder per gallon of  
vehicle.

	Type II
Lbs	Lbs 100 Gals
	63.6 <sup>1b</sup>
	63.6 <sup>2b</sup>
	79.1
	—
	32.3
	0.6
	495

91% vinyl chloride, 3%  
120° C. in cyclohexanone  
86% vinyl chloride, 13%  
th an intrinsic viscosity of

vinyl chloride content of  
viscosity (ASTM Designa-

a specific gravity of 1.31;

enty (ASTM Designation

ty (ASTM Designation D

oxide equivalent

I	Type II
x	19.1 max
9	7.1- 7.5
7	77.2-79.2
x	61 max
x	1/2 max

or spray application

manufacturer's recom-  
s applied.

resin 1a is used, vinyl  
2b shall be used.

he uses the same type  
2.23

n 741-50-76).—

## PAINT

## Classification:

This specification covers a ready-mixed burnt umber tint paint suitable for use as a finish coat on properly prepared structural steel surfaces. This paint may be applied by spray or brush.

## Composition:

Pigment Ingredients		
	Specifications	Lbs 100 Gals
Titanium Dioxide	ASTM Designation D476, Type III or IV	125.7
Yellow Iron Oxide <sup>1</sup>		31.8
Burnt Umber <sup>1</sup>		31.1

Vehicle Ingredients		
Alkyd Resin Solution	TT-B 266, Type III	573.9 <sup>2</sup>
Mineral Spirits	TT-T 291E, Type II, Grade A	117.1
Driers	TT-D 643 and anti-skinning agent	

<sup>1</sup> Ferric oxide (Fe<sub>2</sub>O<sub>3</sub>), 86% minimum, hydrated ferric oxide (Fe<sub>2</sub>O<sub>3</sub>·H<sub>2</sub>O), 99% minimum

<sup>2</sup> Ferric Oxide (Fe<sub>2</sub>O<sub>3</sub>), 61-66%, manganese dioxide (MnO<sub>2</sub>), 9%, silica and silicate minerals, balance

<sup>3</sup> This quantity based on 50% non volatile

Color of pigment raw material shall be such that the color of the paint shall match Color Chip No. 89,  
State Specification 691-80-450

An anti settling agent, not more than 5 pounds per 100 gallons, shall be used to prevent hard settling and  
caking of the pigment in the containers

## Characteristics:

Weight per gallon, in pounds	8.7 min.
Pigment by weight of paint, percent	20.6 min.
Volatiles by weight of paint, percent	47.5 max.
Viscosity, KU	62-70
Drying time Set to touch, hours	2 max
Set to recoating, hours	8 max
	7 min

Fineness of grind, Hegman

Skinning None after 48 hours in a 1/2 full sealed container

Color To match Color Chip No. 89, State Specification 691-80-450

There shall be no objectionable odor.

Working properties shall be satisfactory.

Viscosity range shall be maintained on storage.

## 91-2.15 Vinyl Green Finish Coat (State Specification 741-80-75).—

## Classification:

This specification covers a ready-mixed green vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52), or specified vinyl undercoats. This paint is formulated primarily for spray application.

## Composition:

Pigment Ingredients		
	Type I	Type II
	Lbs 100 Gals	Lbs 100 Gals
Titanium Dioxide	ASTM Designation D476, Type III or IV	8.6
Phthalocyanine Green		5.0
Chrome Oxide Green	TT-P-347	4.7
		38.2

## SECTION 91

Vehicle Ingredients		PAINT
Vinyl Resin <sup>1</sup> .....	87.2	20.0
Vinyl Resin <sup>2</sup> .....	24.8	27.0
Toluene TT-T-548 .....	109	75.1
Normal Butyl Acetate TT-B-838 .....	500	—
Di-(2-ethylhexyl) Phthalate .....	28.8	27.0
Soya Lecithin .....	7.2	6.8
Epoxy Resin <sup>3</sup> .....	0.6	0.6
Methyl Normal Butyl Ketone .....	—	493

<sup>1</sup> A vinyl chloride vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 7% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of 0.57 poise at 20° C. in cyclohexanone.

<sup>2</sup> A vinyl chloride vinyl acetate copolymer resin, specific gravity, 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.53 poise at 20° C. in cyclohexanone.

<sup>3</sup> A vinyl chloride vinyl acetate copolymer resin with a specific gravity of 1.36, vinyl chloride content approximately 84%, vinyl acetate content of approximately 16%, inherent viscosity (ASTM Designation D 1243) of 0.49-0.51.

<sup>4</sup> A vinyl chloride maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.2, inherent viscosity (ASTM Designation D 1243) of 0.31-0.32.

<sup>5</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.36.

<sup>6</sup> A carboxyl modified vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.33.

<sup>7</sup> Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25° C., 180-195 epoxide equivalent.

The preparation of this paint in steel ball mills is not acceptable.

### Characteristics:

	Type I	Type II
Toluene and Isoketones by volume of volatiles, percent	19.0 max.	19.0 max.
Weight per gallon, in pounds	8.0- 8.4	7.5- 7.9
Pigment by weight of paint, percent	6.0- 7.8	5.8- 7.6
Volatiles by weight of paint, percent	73.7-75.7	73.6-75.6
Viscosity, KU	61 max.	61 max.
Fineness of grind, Hegman	6 min.	6 min.
Drying time - set to touch, hours	½ max.	½ max.

Working properties shall be satisfactory.

Color: To match Color Chip No. 72 (State Specification 691-80-450).

The sprayed paint film shall exhibit uniform color and appearance and show no evidence of flooding, floating, or silking.

The label on each container shall bear the legend "For spray application only, not suitable for brush application."

Carbon respirators, maintained according to the manufacturer's recommendations, shall be used when Type II vinyl paints are applied.

NOTE: If vinyl resin 1 is used, vinyl resin 2 shall be used. If vinyl resin 1a is used, vinyl resin 2a shall be used. If vinyl resin 1b is used, vinyl resin 2b shall be used.

Types I or II may be used at the option of the Contractor, providing he uses the same type in Sections 91-2-10, 91-2-11, 91-2-12, 91-2-22, 91-2-15 and 91-2-23.

### 91-2.16 Green Finish Coat (State Specification 741-80-82).—

#### Classification:

This specification covers a ready-mixed green paint suitable for use as a finish coat on properly prepared structural steel surfaces. This paint may be applied by spray or brush.

## PAINT

### Composition:

Titanium Dioxide  
Phthalocyanine Green  
Chrome Oxide Green

Alkyd Resin  
Mineral Spirits  
Driers

\* This quantity based on 50% non  
\* A maximum of 10 percent of the  
adjustments

### Characteristics:

Weight per gallon, in pounds  
Pigment by weight of paint  
Volatiles by weight of paint  
Fineness of grind, Hegman  
Viscosity, KU  
Drying time - set to touch  
set for recoat  
Skimming none after 48 h  
Color: To match Color Chip  
There shall be no objection  
Working properties shall be  
\* Viscosity range shall be min.

91-2.17 (Blank)

91-2.18 (Blank)

91-2.19 Tan Finish Co

### Classification:

This specification  
coat on properly prepared  
by spray or brush.

### Composition:

Yellow Iron Oxide  
Titanium Dioxide

Alkyd Resin  
Mineral Spirits  
Driers

Soya Lecithin, 4 to 5  
material shall be such as  
Specifications 691-80-45  
\* Ferric Oxide (Fe<sub>2</sub>O<sub>3</sub>).

# PAINT

# PAINT

# SECTION 91

## Composition:

87.2	82.0 <sup>1b</sup>
28.8	27.0 <sup>1b</sup>
100	78.3
500	—
28.8	27.0
7.2	6.8
0.6	0.6
—	493

39, containing 6% vinyl chloride, 3% 0.57 poise at 20° C. in cyclohexanone  
35, containing 86% vinyl chloride, 13% carboxyl with an intrinsic viscosity of

viscosity of 1.36 vinyl chloride content of 7% inherent viscosity (ASTM Designa-

polymer with a specific gravity of 1.31,

inherent viscosity (ASTM Designation

inherent viscosity (ASTM Designation D

, 194-195 epoxide equivalent

s not acceptable.

Type I	Type II
19.0 max	19.0 max
8.0- 8.4	7.5- 7.9
6.0- 7.8	5.8- 7.6
73.7-75.7	73.6-75.6
61 max	61 max
n	6 min.
1/2 max	1/2 max

m

color and appearance and show

legend "For spray application

o the manufacturer's recom-  
paints are applied.

sed. If vinyl resin 1a is used, vinyl  
ed, vinyl resin 2b shall be used.  
actor, providing he uses the same  
15 and 91-223

\*41-80-82).—

on paint suitable for use as a  
el surfaces. This paint may be

## Pigment Ingredients

Specifications	Lbs./100 Gals
Titanium Dioxide.....ASTM Designation D476, Type III or IV.....	29.3
Phthalocyanine Green.....	17.0
Chrome Oxide Green.....TT-P-347.....	137.7

## Vehicle Ingredients

Alkyd Resin.....	TT-B-266, Type III.....	525.4 <sup>1</sup>
Mineral Spirits.....	TT-T-291E, Type II, Grade A.....	174.5 <sup>1</sup>
Driers.....	TT-D-643.....	

<sup>1</sup> This quantity based on 50% non-volatile

<sup>2</sup> A maximum of 10 percent of the mineral spirits may be replaced with ethyl benzene for viscosity adjustments

## Characteristics:

Weight per gallon, in pounds.....	8.8 min
Pigment by weight of paint, percent.....	20.6 min
Volatiles by weight of paint, percent.....	49.3 max
Fineness of grind, Hegman.....	7 min
Viscosity, KU.....	62-65 <sup>2</sup>
Drying time: set to touch, hours.....	2 max.
set for recoating, hours.....	8 max.

Skinning: none after 48 hours in a 3/4 full sealed container.

Color: To match Color Chip No. 71 (State Specification 691-80-450)

There shall be no objectionable odor.

Working properties shall be satisfactory.

<sup>2</sup> Viscosity range shall be maintained on storage

91-2.17 (Blank)

91-2.18 (Blank)

91-2.19 Tan Finish Coat (State Specification 741-50-86).—

## Classification:

This specification covers a ready-mixed tan paint suitable for use as a finish coat on properly prepared structural steel surfaces. This paint may be applied by spray or brush.

## Composition:

## Pigment Ingredients

Specifications	Lbs./100 Gals
Yellow Iron Oxide <sup>1</sup> .....	184
Titanium Dioxide.....ASTM Designation D476, Type III or IV.....	92

## Vehicle Ingredients

Alkyd Resin.....	TT-B-266, Type III.....	540
Mineral Spirits.....	TT-T-291E, Type II, Grade A.....	109
Driers.....	TT-D-643 and anti-skinning agent..	

Soya Lecithin, 4 to 5 pounds per 100 gallons to prevent hard settling. Color of raw material shall be such that the color of the paint shall match Color Chip No. 86 (State Specifications 691-80-450).

<sup>1</sup> Ferric Oxide (Fe<sub>2</sub>O<sub>3</sub>), 86% minimum. Hydrated Ferric Oxide (Fe<sub>2</sub>O<sub>3</sub> · H<sub>2</sub>O) 99% minimum



## SECTION 91

PAINT

PAINT

### Characteristics:

Weight per gallon, in pounds at 77° F.	9.4 min
Pigment by weight of paint, percent	27.5 min
Volatiles by weight of paint, percent	42 max
Fineness of grind, Hegman	7 min
Viscosity at 77° F., KU	62-70 <sup>1</sup>
Drying time set to touch, hours at 77° F.	2 max
set for recoating, hours at 77° F.	8 max

Skinning none after 48 hours in a 3/4 full sealed container.

Color To match Color Chip No. 86 (State Specification 691-80-450).

There shall be no objectionable odor.

Working properties shall be satisfactory.

<sup>1</sup>Viscosity range shall be maintained on storage.

### 91-2.20 (Blank)

### 91-2.21 Burnt Sienna Finish Coat (State Specification 741-80-88).—

#### Classification:

This specification covers a ready-mixed burnt sienna paint suitable for use as a finish coat on properly prepared structural steel surfaces. This paint may be applied by spray or brush.

#### Composition:

Pigment Ingredients		
	Specifications	Lbs./100 Gals.
Burnt Sienna <sup>1</sup>		113.7
Titanium Dioxide	ASTM Designation D476, Type III or IV	61.5

<sup>1</sup> Ferrous oxide (Fe<sub>2</sub>O<sub>3</sub>), 56-61%, silica and silicate minerals, balance

Vehicle Ingredients		
Alkyd Resin	TT-R-266, Type III	57.7
Mineral Spirits	TT-T-291E, Type II, Grade A	118.8
Driers	TT-D-643 and anti-skinning agent	

An anti-settling agent, not more than 7 pounds per 100 gallons shall be used to prevent hard settling and caking of the pigment in the containers. Color of raw materials shall be such that the color of the paint shall match Color Chip No. 84 (State Specification 691-80-450).

### Characteristics:

Weight per gallon, in pounds at 77° F.	8.6 min
Pigment by weight of paint, percent	19.6 min
Volatiles by weight of paint, percent	46.5 max
Fineness of grind, Hegman	6 min
Viscosity at 77° F., KU	62-70 <sup>1</sup>
Drying time set to touch, hours at 77° F.	2 max
set for recoating, hours at 77° F.	8 max

Skinning none after 48 hours in a 3/4 full sealed container.

Color To match Color Chip No. 84 (State Specification 691-80-450).

There shall be no objectionable odor.

Working properties shall be satisfactory.

<sup>1</sup>Viscosity range shall be maintained on storage.

### 91-2.22 White Tint Base Vinyl Finish Coat (State Specification 741-80-147).—

Classification:

This specification covers

use on properly

Treatment,

formulated

Composition:

Titanium Dioxide

Vinyl Resin<sup>1</sup>

Vinyl Resin<sup>2</sup>

Toluene

Normal Butyl Acetate

D (2 ethylhexyl)

Soya Lecithin

Epoxyl Resin<sup>3</sup>

Methyl Normal

When light

titanium dioxide

pigments

<sup>1</sup> A vinyl chloride

vinyl acetate

vinyl acetate

vinyl acetate

0.83 parts at 20°

<sup>2</sup> A vinyl chloride

approximately

ton D 1243) c

<sup>3</sup> A vinyl chloride

inherent visc

<sup>4</sup> A partially hyd

D 1243), 0.84,

<sup>5</sup> A carbonyl me

1243), 0.84,

<sup>6</sup> Liquid, color 3

The prepara

Character

Toluene and

minum

Weight per

Pigment by

Volatiles by

Viscosity, KU

Fineness of

Drying time

The spray

evidence of

Working

## PAINT

2 min  
7 min  
42 max  
7 min  
62-70<sup>1</sup>  
2 max  
8 max

(50)

-50-55).—

unt suitable for use  
ices. This paint may

Lbs /100 Gals

113.7

61.5

577

118.8

shall be used to prevent  
of raw materials shall be  
ite Specification 691-80-

8.6 min  
19.6 min.  
45.5 max.  
6 min  
62-70<sup>1</sup>  
2 max  
8 max

(50)

fication 741-50-147).—

## PAINT

## Classification:

This specification covers a ready-mixed white tint base vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52). This paint is formulated primarily for spray application.

## Composition:

Pigment Ingredients		Type I	Type II
Specifications		Lbs/100 Gals	Lbs/100 Gals
Titanium Dioxide.....	ASTM Designation D 476, Type III or IV.....	72.7	72.7
Vehicle Ingredients			
Vinyl Resin <sup>1</sup> .....		87.2	84.8 <sup>1b</sup>
Vinyl Resin <sup>2</sup> .....		28.8	28.6 <sup>2b</sup>
Toluene.....	TT-T-548.....	109	76.9
Normal Butyl Acetate.....	TT-B-538.....	495	—
Di-(2-ethylhexyl) Phthalate.....		28.8	28.8
Soya Lecithin.....		7.2	7.2
Epoxy Resin <sup>3</sup> .....		0.6	0.6
Methyl Normal Butyl Ketone.....		—	490

When light to medium tints are specified, not over 30 percent by weight of the titanium dioxide may be replaced by an equal weight of the light-fast tinting pigments.

<sup>1</sup> A vinyl chloride vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of 0.57 poise at 20° C. in cyclohexanone.

<sup>2</sup> A vinyl chloride vinyl acetate copolymer resin, specific gravity 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.53 poise at 20° C. in cyclohexanone.

<sup>1b</sup> A vinyl chloride vinyl acetate copolymer resin with a specific gravity of 1.36, vinyl chloride content of approximately 84%, vinyl acetate content of approximately 16%, inherent viscosity (ASTM Designation D 1243) of 0.49-0.51.

<sup>2b</sup> A vinyl chloride maleate diester-unsaturated carboxylic acid terpolymer with a specific gravity of 1.31, inherent viscosity (ASTM Designation D 1243) of 0.31-0.32.

<sup>1b</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.36.

<sup>2b</sup> A carboxyl modified vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.33.

<sup>3</sup> Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25° C., 180-195 epoxide equivalent.

The preparation of this paint in steel ball mills is not acceptable.

## Characteristics of Tinted Paint:

	Type I	Type II
Toluene and Isoketones by volume of volatiles, percent, maximum.....	19.0	19.0
Weight per gallon, in pounds.....	8.1-8.5	7.7-8.1
Pigment by weight of paint, percent.....	8.0-10.1	8.4-10.5
Volatiles by weight of paint, percent.....	71.0-73.8	69.9-72.7
Viscosity, KU, maximum.....	61	61
Fineness of grind, Hegman, Minimum.....	6	6
Drying time - set to touch, hours maximum.....	½	½

The sprayed paint film shall exhibit uniform color and appearance and show no evidence of flooding, floating, or silking.

Working properties shall be satisfactory.

## SECTION 91

PAINT

The label on each container shall bear the legend, "For spray application only not suitable for brush application."

Carbon respirators, maintained according to the manufacturer's recommendations, shall be used when Type II vinyl paints are applied.

NOTE: If vinyl resin 1 is used, vinyl resin 2 shall be used. If vinyl resin 1a is used, vinyl resin 2a shall be used. If vinyl resin 1b is used, vinyl resin 2b shall be used. Types I or II may be used at the option of the Contractor, providing he uses the same type in Sections 91-2.10, 91-2.11, 91-2.12, 91-2.15, 91-2.22, and 91-2.23.

### 91-2.23 Vinyl Iridescent Green Finish Coat (State Specification 741-80-7b).—

#### Classification:

This specification covers a ready-mixed iridescent green vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52), or specified vinyl undercoats. This paint is formulated primarily for spray application.

#### Composition:

##### Pigment Ingredients

Specifications	Type I	Type II
	Lbs. 100 Gals.	Lbs. 100 Gals.
Organic Green Gold <sup>1</sup>	2.4	2.3
Phthalocyanine Green	6.9	6.5
Aluminum Powder TT-P-320, Type I, Class 2, non-leafing	24.0	22.7
Vinyl Resin <sup>2a</sup>	87.2	82.0 <sup>b</sup>
Vinyl Resin <sup>2b</sup>	28.8	27.0 <sup>b</sup>
Toluene TT-T-548	109	78.3
Normal Butyl Acetate TT-B-838	500	—
Di-(2-ethylhexyl) Phthalate	28.8	27.0
Soya Lecithin	7.2	6.6
Epoxy Resin <sup>4</sup>	0.6	0.6
Methyl Normal Butyl Ketone	—	493

<sup>1</sup> Organic Green Gold: Specific Gravity 1.61 ± 0.05, contrast ratio (5 mil wet film thickness, 15% P.V.C. in a medium length soya type alkyl resin with enamel viscosity adjusted to 70 KU with mineral spirits), 0.94 minimum, trichromatic coefficients (when 10% of the pigment is blended with 90% titanium dioxide in a medium length soya type alkyl resin at 20% P.V.C.) x = 0.358 ± 0.003, y = 0.440 ± 0.003, Z = 0.600 ± 0.003.

<sup>2a</sup> A vinyl chloride vinyl acetate copolymer resin, specific gravity 1.39, containing 91% vinyl chloride, 3% vinyl acetate and 6% vinyl alcohol with an intrinsic viscosity of 0.57 poise at 20° C. in cyclohexanone.

<sup>2b</sup> A vinyl chloride vinyl acetate copolymer resin, specific gravity 1.35, containing 86% vinyl chloride, 13% vinyl acetate and 1% interpolymerized dibasic acid (0.7 to 0.8 carboxyl) with an intrinsic viscosity of 0.53 poise at 20° C. in cyclohexanone.

<sup>3a</sup> A vinyl chloride vinyl acetate copolymer resin with a specific gravity of 1.36, vinyl chloride content of approximately 84%, vinyl acetate content of approximately 16%, inherent viscosity (ASTM Designation D 1243) of 0.49-0.51.

<sup>3b</sup> A vinyl chloride maleate diester unsaturated carboxylic acid terpolymer with a specific gravity of 1.31, inherent viscosity (ASTM Designation D 1243) of 0.31-0.32.

<sup>4</sup> A partially hydrolyzed vinyl chloride/vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.36.

<sup>5</sup> A carboxyl modified vinyl chloride vinyl acetate copolymer, inherent viscosity (ASTM Designation D 1243), 0.54, specific gravity 1.33.

<sup>6</sup> Liquid, color 5 max. (Gardner), 100-160 poise viscosity at 25° C., 180-195 epoxide equivalent.

The preparation of this paint in steel ball mills is not acceptable.

PAINT

#### Characteristics:

Toluene and ketone  
Weight per gallon, 11.5  
Pigment by weight, 14  
Volatiles by weight, 4  
Viscosity, KU, 70  
Fineness of grind, 100  
Drying time, set to 1

#### Working properties:

Color, 10 max.  
The sprayed paint  
no evidence of  
The label on container  
not suitable for  
Carbon respirators,  
shall be used.  
NOTE: If vinyl  
resin 2a  
Types I or II  
type

### 91-3.01 Wood

#### Classification:

This specification covers  
wood or exterior  
cathion TT-P-00

### 91-3.02 Paint

#### Classification:

This specification covers  
to outside exposure  
cathion TT-P-00  
Unpainted  
721-80-01).

### 91-3.03 Enamel

#### Classification:

This specification covers  
Composition:

Carbon Black<sup>1</sup>

Alkyd Resin  
Thinner  
Driers

# PAINT

spray application only,

u s recommenda-

esin la is used, vinyl resin  
hall be used

ng he uses the same type  
-2 23

ification 741-80-78).—

reen vinyl finish paint  
ive been treated with  
n 701-80-52), or speci-  
for spray application.

Type I Gals	Type II Lbs /100 Gals
4	23
9	65
3	227
2	620 <sup>b</sup>
5	270 <sup>b</sup>
	763
	—
	27.0
	6.8
	0.6
	493

film thickness, 15% P.V.C.  
0.11 (mineral spirits),  
ch 90% titanium  
± 0.003, y = 0.440 ± 0.010.

g 91% vinyl chloride, 3%  
120° C in cyclohexanone  
± 0.05% vinyl chloride, 13%  
ch an intrinsic viscosity of

vinyl chloride content of  
viscosity (ASTM Designa-

a specific gravity of 1.31.

ity (ASTM Designation

v (ASTM Designation D

side equivalent

ceptable.

# PAINT

## Characteristics:

	Type I	Type II
Toluene and Isoketones, by volume of volatiles, percent.....	19.0 max.	19.0 max.
Weight per gallon, in pounds.....	7.7-8.1	7.3-7.7
Pigment by weight of paint, percent.....	3.8-4.8	3.7-4.7
Volatiles by weight of paint, percent.....	75.6-77.6	75.6-77.6
Viscosity, KU.....	61 max.	61 max.
Fineness of grind, Hegman.....	6 min.	6 min.
Drying time - set to touch, hours.....	½ max.	½ max.

Working properties shall be satisfactory.

Color: To match Color Chip No. 09 (State Specification 691-80-450).

The sprayed paint film shall exhibit uniform color and appearance and show no evidence of flooding, floating, or silking.

The label on each container shall bear the legend, "For spray application only, not suitable for brush application."

Carbon respirators, maintained according to the manufacturer's recommendations, shall be used when Type II vinyl paints are applied.

NOTE: If vinyl resin 2 is used, vinyl resin 3 shall be used. If vinyl resin 2a is used, vinyl resin 3a shall be used. If vinyl resin 2b is used, vinyl resin 3b shall be used. Types I or II may be used at the option of the Contractor, providing he uses the same type in Sections 91-2 10, 91-2 11, 91-2 12, 91-2 15, 91-2 22 and 91-2 23.

## 91-3 PAINTS FOR WOOD

### 91-3.01 Wood Primer (State Specification 721-80-01). —

#### Classification:

This specification covers a ready-mixed priming paint for use on unpainted wood or exterior woodwork. It shall comply, in all respects, with Federal Specification TT-P-0025D, except that it shall dry hard in not more than 12 hours.

### 91-3.02 Paint, Latex-Base for Exterior Wood, White and Tints (State Specification 721-80-06). —

#### Classification:

This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures. This paint shall comply in all respects with Federal Specification TT-P-0096B.

Unpainted wood shall first be primed with Wood Primer (State Specification 721-80-01).

### 91-3.03 Enamel; Sign Post, Black (State Specification 741-80-09). —

#### Classification:

This specification covers a gloss black enamel for use on wood or metal.

#### Composition:

Pigment Ingredients		
Specifications	Lbs	100 Gals
Carbon Black <sup>1</sup> .....		32
Vehicle Ingredients		
Alkyd Resin.....	TT-R-266, Type III.....	593
Thinner.....	TT-T-291E, Type II, Grade A.....	126
Driers.....	TT-D-643.....	
		751

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## PAINT

<sup>1</sup>Surface area, square meters/gram, 115-130; particle diameter, millimicrons, 15-20; pH, 7.5-8.5; free carbon (moisture free), percent, 95-98; volatile matter, percent, 2-4; oil absorption, stiff paste end-point (CCN, gram, 0.45-0.50)

## Characteristics:

Phthalic Anhydride, by weight of non-volatile vehicle, percent	29.0 min
Weight per gallon, in pounds	7.5 min
Pigment by weight of paint, percent	4.0 min
Volatiles by weight of paint, percent	57.0 max
Fineness of grind, Hegman	7 min
Viscosity, KU	70-80
Drying time - set to touch, hours	2 max
dry through, hours	8 max
Gloss, 60°, at 48 hours	85 min
Coarse particles, percent	1.0 max
Water, percent	0.5 max

There shall be no objectionable odor.

Working properties shall be satisfactory.

## 91-3.04 Enamel; Sign Post, Yellow (State Specification 701-S0 08).—

## Classification:

This specification covers an enamel for use on either wood or metal sign posts

## Composition:

Pigment Ingredients		
Specifications		Lbs /100 Gals
Medium Chrome Yellow	TT-P-346, Type III	305
Vehicle Ingredients		
Alkyd Resin	TT-R-266, Type III	572 <sup>1</sup>
Mineral Spirits	TT-T-291E, Type II, Grade A	126
Driers	TT-D-643 and anti-skinning agent	

<sup>1</sup> This quantity based on 50% non-volatile

## Characteristics:

Weight per gallon, in pounds	10.0 min
Pigment by weight of paint, percent	30.4 min
Volatiles by weight of paint, percent	41 max
Phthalic Anhydride, by weight of non-volatile vehicle, percent	29 min
Lead Chromate, by weight of pigment, percent	87.0 min
Viscosity, KU	67-75
Drying time - set to touch, hours	2 max
dry through, hours	8 max
Gloss, 60°, at 48 hours	85 min
Fineness of grind, Hegman	7 min
Color: To match Color Chip No. 57, (State Specification 691-80-450)	
There shall be no objectionable odor.	
Working properties shall be satisfactory.	

## 91-3.05 Paint; Vinyl-Acrylic Emulsion, Exterior White and Tints (State Specification 721-S0-11).—

## Classification:

This specification covers a vinyl-acrylic emulsion paint designed for use on exterior masonry. This paint shall comply in all respects to Federal Specification TT-P-55a, Paint, Polyvinyl Acetate Emulsion, Exterior, Type II, latest revision,

## PAINT

except as follows:

1. The copolymer shall
2. The viscosity shall
3. The grind shall be
4. Dry opacity at 3
5. All colors shall be
6. The wet abrasion called for in TT-sample passes
7. No lead or mercur

## Composition:

The vehicle shall be copolymerized with a the necessary additive

## Characteristics:

Weight per gallon in  
Pigment by weight of  
(2%) lbs. TiO<sub>2</sub> per g.  
Total solids by weight  
Fineness of grind, Heg  
Viscosity, KU  
Drying time - set to to  
dry three  
Dry opacity - white pa  
for tints

Note: For complete

This paint may be t  
trates. Avoid dark co

91-4.01 Enamel; Tra  
16).—

## Classification:

This specification c  
signal hoods, shields,  
Pre-Treatment, Vinyl  
first to insure proper

## Composition:

Carbon Black<sup>1</sup>  
China Clay

Alkyd Resin  
Thinner  
Driers

<sup>1</sup>Surface area, square meter  
carbon (moisture free), pe

# PAINT

pH 7.5-8.5, fixed  
oil paste endpoint,

.....	200 min
.....	7.5 min
.....	4.0 min
.....	57.0 max
.....	7 min
.....	70-80
.....	2 max
.....	8 max
.....	85 min
.....	1.0 max
.....	0.5 max

701-80-08).—

od or metal sign posts.

Lbs./100 Gals

..... 305

..... 572<sup>1</sup>

..... } 126

.....	10.0 min
.....	30.4 min
.....	41 max
.....	29 min
.....	87.0 min
.....	67-75
.....	2 max
.....	8 max
.....	85 min
.....	7 min

(0.450)

d Tints (State Specifi-

designed for use on  
Federal Specification  
pe II, latest revision,

# PAINT

except as follows:

1. The copolymer shall be vinyl-acrylic.
2. The viscosity shall be from 80 to 90 KU.
3. The grind shall be not less than 5.
4. Dry opacity at 3 mils wet film thickness (6 mil gap).
5. All colors shall be alkali resistant and light-fast.
6. The wet abrasion test shall be made on a primed glass panel prepared as called for in TT-P-29b, Section 4.5.5.1. Leneta charts are permissible if sample passes.
7. No lead or mercury compound shall be present.

## Composition:

The vehicle shall be Type II and consist of a water dispersion of vinyl-acetate, copolymerized with an acrylic plasticizer, together with minimum amounts of the necessary additives.

## Characteristics:

Weight per gallon in pounds .....	11.0 min
Pigment by weight of paint, percent .....	32 max
(2 1/2 lbs. TiO <sub>2</sub> per gal for white)	
Total solids by weight, percent .....	50 min
Fineness of grind, Hegman .....	5 min
Viscosity, KU .....	80-90
Drying time set to touch, hours .....	1/2 max
dry through, hours .....	1 max
Dry opacity white paints (3 mils wet film 6 mil gap) .....	0.98 min
for tints (3 mils wet film 6 mil gap) .....	0.99 min

NOTE For complete characteristics, see Federal Specification

This paint may be tinted by using "universal" or "all purpose" color concentrates. Avoid dark colors.

## 91-4 MISCELLANEOUS PAINTS

91-4.01 Enamel; Traffic Signal, Lusterless, Black (State Specification 741-80-16).—

## Classification:

This specification covers a lusterless black enamel for use in painting traffic signal hoods, shields, and other surfaces. When used on bare aluminum or zinc, Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52) shall be used first to insure proper bond.

## Composition:

Pigment Ingredients	
Specifications	Lbs./100 Gals
Carbon Black <sup>1</sup> .....	54
China Clay .....	292
Vehicle Ingredients	
Alkyd Resin .....	TT-R-266, Type III 399
Thinner .....	TT-T-291E, Type II, Grade A 194
Driers .....	TT-D-643 939

<sup>1</sup>Surface area, square meters/gram, 115-130; particle diameter, millimicrons, 16-20; pH, 7.5-8.5; fixed carbon (moisture free), percent, 96-98; volatile matter, percent, 2-4; oil absorption, stiff paste endpoint,

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PAINT

PAINT

CCS/gram, 0.84-0.90

## Characteristics:

Phthalic Anhydride, by weight of non-volatile vehicle, percent.....	29.0
Weight per gallon, in pounds.....	9.5
Pigment by weight of paint, percent.....	36.0
Volatiles by weight of paint, percent.....	42.4
Fineness of grind, Hegman.....	4 min
Viscosity, KU.....	75-90
Drying time - set to touch, hours.....	2 max
dry through, hours.....	8 max
Coarse particles, percent.....	1.0 max
Water, percent.....	0.5 max
There shall be no objectionable odor.	
Working properties shall be satisfactory.	

Flexibility. Paint shall pass bending test over 1/4 inch mandrel after 2 hours air drying and 24 hours at 105° C., Federal Test Method Standard No 14; Method 6221, wet film thickness 3 mils.

## 91-4.02 Enamel; Traffic Signal, Dark Olive Green (State Specification 741-17).—

### Classification:

This specification covers an enamel for use on signal poles and is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52).

### Composition:

#### Pigment Ingredients

Specifications	Lbs 100 Gals
Iron Oxide (dark orange shade).....	83
Carbon Black <sup>1</sup> .....	3
Iron Blue..... TT-P-385 Milori Blue Shade.....	17
<b>Vehicle Ingredients</b>	
Alkyd Resin..... TT-R-266, Type III.....	530
Thinner..... TT-T-291E, Type II, Grade A.....	185
Driers..... TT-D-643.....	818

<sup>1</sup>Surface area, square meters/gram, 115-130, particle diameter, millimicrons, 18-20, pH, 7.5-8.5, fixed carbon (moisture free), percent, 96-98, volatile matter, percent, 2-4, oil absorption, stiff paste endpoint CCS/gram, 0.84-0.90

## Characteristics:

Weight per gallon, in pounds.....	7.9 min
Pigment by weight of paint, percent.....	12.3 min
Volatiles by weight of paint, percent.....	55.8 max
Fineness of grind, Hegman.....	7 min
Viscosity, KU.....	65-75
Drying time - set to touch, hours.....	2 max
dry through, hours.....	8 max
Gloss, 60° at 48 hours.....	65 min
Coarse particles, percent.....	1.0 max
Water, percent.....	0.5 max
Phthalic anhydride, by weight of non-volatile vehicle, percent.....	29.0 min
Color: To match Color Chip No. 68 (State Specification 691-80-450).	

There shall be  
Working prop

91-4.03 Enamel

Classification

This specifies  
as a finishing  
Specification 70

Composition

Fluoro Yellow G  
Organic Green Col  
Titanium Dioxide

Alkyd Resin  
Thinner  
Driers

Organic Green Col  
in a medium length  
0.94 minimum free  
oxide in a medium  
1 - 0.34 1.00

## Characteristics

Phthalic Anh  
Weight per p  
Pigment by w  
Volatiles by  
Fineness of g  
Viscosity, KU  
Drying time

Gloss, 60° at  
Coarse partic  
Water, percen  
Color: To m  
There shall  
Working pro

91-4.04 White  
741-80-70).—

Classification

This speci  
the interior

## PAINT

.....	29.0 min.
.....	9.5 min.
.....	36.0 min.
.....	42.6 max.
.....	4 min.
.....	75-90
.....	2 max.
.....	8 max.
.....	1.0 max.
.....	0.5 max.

mandrel after 2 hours  
mod Standard No. 141,

ic Specification 741-80-

poles and is formulated  
yl Wash Primer (State

Lbs./100 Gals.	
.....	83
.....	3
.....	17
.....	
.....	530
.....	185
.....	818

ns, 15-30, pH, 7.5-8.5, fixed  
sorption, stiff paste endpoint,

.....	7.9 min.
.....	12.3 min.
.....	55.8 max.
.....	7 min.
.....	65-75
.....	2 max.
.....	8 max.
.....	85 min.
.....	1.0 max.
.....	0.5 max.
.....	29.0 min.

0-450).

## PAINT

There shall be no objectionable odor  
Working properties shall be satisfactory

## 91-4.03 Enamel; Traffic Signal Yellow (State Specification 741-80-18).—

## Classification:

This specification covers an enamel for use on signal poles and is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Specification 701-80-52).

## Composition:

Pigment Ingredients		
	Specifications	Lbs./100 Gals
Hansa Yellow G.....	MIL-H-10330.....	46
Organic Green Gold <sup>1</sup> .....	.....	18
Titanium Dioxide.....	ASTM Designation D 476, Type III or IV.....	41
Vehicle Ingredients		
Alkyd Resin.....	TT-R-266, Type III.....	587
Thinner.....	TT-T-291E, Type II, Grade A.....	105
Driers.....	TT-D-643.....	797

<sup>1</sup> Organic Green Gold. Specific Gravity  $1.61 \pm 0.05$ , contrast ratio (5 mil wet film thickness, 15% P.V.C. in a medium length soya type alkyd resin with enamel viscosity adjusted to 70 KU with mineral spirits), 0.94 minimum, trichromatic coefficients (when 10% of the pigment is blended with 90% titanium dioxide in a medium length soya type alkyd resin at 20% P.V.C.)  
 $x = 0.388 \pm 0.003$ ,  $y = 0.446 \pm 0.003$ ,  $Y = 0.630 \pm 0.003$

## Characteristics:

Phthalic Anhydride, by weight of non-volatile vehicle, percent.....	29.0 min
Weight per gallon, in pounds.....	7.9 min.
Pigment by weight of paint, percent.....	13.0 min
Volatiles by weight of paint, percent.....	50.5 max
Fineness of grind, Hegman.....	7 min
Viscosity, KU.....	75-80
Drying time set to touch, hours.....	2 max
dry through, hours.....	8 max
Gloss, 60° at 48 hours.....	85 min
Coarse particles, percent.....	1.0 max
Water, percent.....	0.5 max

Color To match Color Chip No. 54 (State Specification 691-80-450).

There shall be no objectionable odor.

Working properties shall be satisfactory.

## 91-4.04 White Epoxy Enamel Concrete Coating (State Specification 741-80-70).—

## Classification:

This specification covers a 2-package white epoxy enamel system for painting the interior of concrete tunnels and other concrete structures when so specified.



## SECTION 91

PAINT

PAINT

## Composition:

Package A		
	Specifications	Lbs./100 Gals
Titanium Dioxide	ASTM Designation D 476, Type III or IV	295
Epoxy Resin <sup>1</sup>		390
Toluene	TT-T-548	36.8
Ethylene Glycol Monoethyl Ether	TT-E-781	82.8
Methyl Ethyl Ketone	TT-M-261	72.7
Ethylene Glycol Monoethyl Ether Acetate	MIL-E-7125	63.6
Copper Phthalocyanine	TT-P-355, Type I	0.1-0.3 oz
Normal Butyl Acetate	TT-B-838	93.7
Soya Lecithin		5.0

Package B		
	Specifications	Lbs./100 Gals
Polyanide Resin <sup>2</sup>		219
Unmodified Urea-Formaldehyde Resin <sup>3</sup>		40
Ethylene Glycol Monoethyl Ether	TT-E-781	100
Toluene	TT-T-548	66.9
Normal Butyl Acetate	TT-B-838	111
Methyl Ethyl Ketone	TT-M-261	81
Titanium Dioxide	ASTM Designation: D 476, Type III or IV	297
Ethylene Glycol Monoethyl Ether Acetate	MIL-E-7125	77.5
Soya Lecithin		5.0

<sup>1</sup> Melting point 65-75° C.; Durans Mercury method, Epoxide equivalent, 425-550. Viscosity, D-G in a 40 percent by weight solution in butyl carbitol. Color, 4 Gardner maximum in a 40 percent by weight solution in butyl carbitol.

<sup>2</sup> Amine value, 220-240. Viscosity, 31-38 poise at 75° C.; Ash 0.05 percent, weight per gallon, 8.3 pounds at 25° C. Flash point, 295° C.; (ASTM Designation D 92); Color, Gardner 1933 6-10.

<sup>3</sup> Solids, 60%  $\pm$  2%, Butyl alcohol, 35%  $\pm$  2%, Xylol, 5%; Color, Gardner 1933, maximum, 1. Viscosity, Gardner-Holdt, 25° C., S-V, Hydrocarbon solvent tolerance\*, minimum, 350. Acid number, solid resin 0.5-2.0. Weight per gallon, 8.5 pounds.

\* Pounds of hydrocarbon solvent mixture (76.4% pure grade normal heptane and 23.6% C.P. toluene, by weight) tolerated by 100 pounds of resin solution.

## Characteristics:

	Package A	Package B
Pigment by weight of paint, percent	27.3-28.7	9.2-31.4
Titanium Dioxide by weight of pigment, percent	91.0 min	91.0 min
Volatiles by weight of paint, percent	33.2-35.8	44.4-46.4
Weight per gallon, in pounds	10.5-10.9	9.8-10.2
Fineness of grind, Hegman	7 min	7 min
Toluene, percent by volume of volatiles	17.0 max	17.0 max
Viscosity, KU	60-70	55-65
Xylene, percent by volume of volatiles	—	1.0 max
Amine number on vehicle	—	72-77
Weight, grams per epoxide equivalent on vehicle	824-1066	—

## Mixed Paint

When Packages A and B are mixed in equal parts by volume, a sprayed film shall set to the touch in not more than 2 hours.

Properties of Co  
at Gloss, Index  
Reflectance, Fe  
Yellowness, Fe  
Color, To mate

The work is

Labeling:  
The label on  
Package  
to stand 34

91-4.05 (Blan

91-4.06 (Blan

91-4.07 (Blan

91-4.08 (Blan

91-4.09 Enan

Classification:

This specifi

on exterior an

by easy brush

with freedom

This specifi

489, Class A,

This enan

Type II, Gra

## PAINT

## PAINT

## SECTION 91

..... *Lbs /100 Gals*

nation D 476,	
IV .....	298
.....	399
.....	56.8
.....	62.8
.....	72.7
.....	63.8
pe 1 .....	0.1-0.3 oz.
.....	93.7
.....	5.0

..... *Lbs /100 Gals*

.....	219
.....	40
.....	100
.....	66.9
.....	111
.....	81
gnation D 476,	
IV .....	297
.....	77.5
.....	5.0

ivalent, 425-550, Viscosity D-G in a 40  
r maximum in a 40 percent by weight

percent, weight per gallon, 8.3 pounds  
Vor, Gardner 1933 6-10

Gard 1933, maximum, 1, Viscosity,  
n 350, Acid number, solid resin,

nal heptane and 23.6% C P toluene, by

<i>Package A</i>	<i>Package B</i>
..... 27.3-28.7	..... 9.2-31.4
..... 91.0 min.	..... 91.0 min.
..... 33.2-35.8	..... 44.4-46.4
..... 10.5-10.9	..... 9.8-10.2
..... 7 min.	..... 7 min.
..... 17.0 max.	..... 17.0 max.
..... 60-70	..... 55-65
.....	..... 1.0 max.
.....	..... 72-77
..... 824-1066	.....

parts by volume, a sprayed film  
ITS.

## Properties of Cured Paint Film After 48 Hours at 77 F:

60° Gloss, Federal Test Method Standard No. 141, Method 6101	90 Min
Reflectance, Federal Test Method Standard No. 141, Method 6121	84 min
Yellowness, Federal Test Method Standard No. 141, Method 6131	0.0 max
Color, To match Color Chip No. 36, State Specification 691.80.450	

The working properties of this material shall be satisfactory.

## Labeling:

The label on each container shall state the following:

Packages A and B shall be mixed in equal parts by volume and allowed  
to stand 30 minutes before using.

91-4.05 (Blank)

91-4.06 (Blank)

91-4.07 (Blank)

91-4.08 (Blank)

91-4.09 Enamel, Gloss, Industrial (State Specification 721.80.81).—

## Classification:

This specification covers a high-grade synthetic-type high gloss enamel for use  
on exterior and interior metal. It is highly weather-resistant and is characterized  
by easy brushing, good color and gloss retention, good drying and flexibility,  
with freedom from after-tack.

This specification shall conform in all respects to Federal Specification TT-E-  
489, Class A, Air Drying.

This enamel may be thinned with Thinner, Federal Specification TT-T-291E,  
Type II, Grade A (Mineral Spirits).

## NOTICE

The contents of this report reflect the views of the Office of Transportation Laboratory which is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Neither the State of California nor the United States Government endorse products or manufacturers. Trade or manufacturers' names appear herein only because they are considered essential to the object of this document.

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO. FHWA-CA-TL-78-21		2. GOVERNMENT ACCESSION NO.		3. RECIPIENT CATALOG NO.	
4. TITLE AND SUBTITLE IMPROVEMENT OF THE PERFORMANCE OF ZINC RICH PRIMER				5. REPORT DATE June 1978	
6. AUTHOR(S) R. Warness				7. PERFORMING ORGANIZATION REPORT NO. 19704-657283	
8. PERFORMING ORGANIZATION NAME AND ADDRESS Office of Transportation Laboratory California Department of Transportation Sacramento, California 95819				9. WORK UNIT NO.	
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14. SUPPLEMENTARY NOTES This project was performed in cooperation with the U.S. Department of Transportation, Federal Highway Administration.					
15. ABSTRACT The performance of an organic zinc-rich primer formulated with various zinc dusts, suspending agents and moisture control materials was evaluated.  Some zinc dusts and additives adversely affected the performance when tested according to ASTM B117, Salt Spray.					
16. KEY WORDS Zinc-rich primer, corrosion, blister, deposits.			17. DISTRIBUTION STATEMENT No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161.		
18. SECURITY CLASS. OF THIS REPORT Unclassified		19. SECURITY CLASS. OF THIS PAGE Unclassified		20. NO. OF PAGES 14	

DS-TL-1242 (Rev. 6/76)

STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF CONSTRUCTION  
OFFICE OF TRANSPORTATION LABORATORY

June 1978

FHWA No. D-5-54  
TL No. 657283

Mr. C. E. Forbes  
Chief Engineer

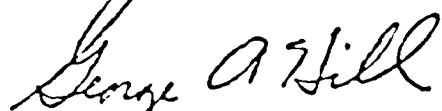
Dear Sir:

I have approved and now submit for your information this  
final research project report titled:

IMPROVEMENT OF THE PERFORMANCE OF  
ZINC RICH PRIMER

Study made by . . . . . Enviro-Chemical Branch  
Under the Supervision of . . . . . Earl Shirley  
Co-Principal Investigators . . . . . Raymond Warness  
Thomas L. Shelly  
Report Prepared by . . . . . Raymond Warness

Very truly yours,



GEORGE A. HILL  
Chief, Office of Transportation Laboratory

Attachment

RW:lb

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ARTECH CORP FALLS CHURCH VA  
REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS, (11)

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SEP 79 F ORDWAY, M J HAMMELL

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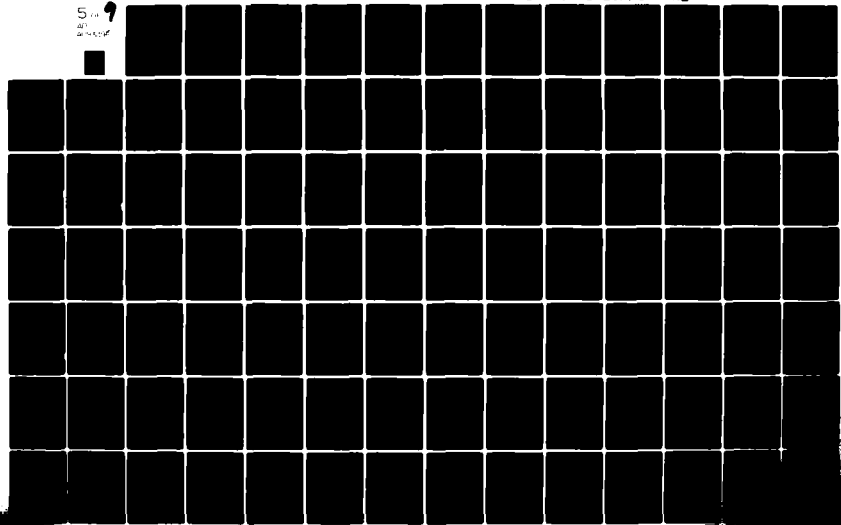
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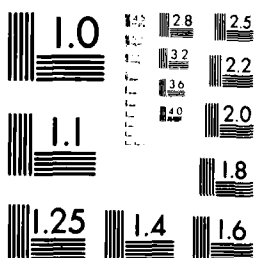


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5 OF 9

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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



## INTRODUCTION

Since 1973, a single-package organic zinc-rich Primer, State specification 8010-61J-36 (formerly 741-80-62), has been specified for priming blast-cleaned structural steel. The compositional part of the specification is shown in Figure 1. Although most applications using this material have been satisfactory, occasionally white deposits or blisters with rust underneath, have developed on the primed surface. These adversely affect the overall performance of the paint system. This condition has occurred in both full scale field applications and laboratory tests of primers which conformed to the specification.

Failures of this type were not noted during the development and testing of the primer. At that time, blisters and rust formation in salt spray tests were limited to the surface of the metal next to a scribed line. Therefore, the performance requirements in the specification referred only to undercutting and rust at the scribe line.

In an effort to determine the cause of the deposits and blisters, laboratory formulations of the zinc primer were made and evaluated using different zinc dusts and various additives as permitted by the specifications.

## CONCLUSIONS

The performance of an organic zinc-rich primer, State specification 8010-61J-36, was affected by both the type and purity of zinc dust and the type of additives that were used in making primers to meet this specification. However, it was possible to formulate primers in the laboratory that did not show undercutting of the scribe or exhibit any other

surface defect of the metal after 1,000 hours in the salt spray. These primers were made using the following materials:

- 1) Zinc dusts with a higher metallic zinc content than the minimum required by the specification.
- 2) Colloidal hydrophobic silica as a suspending agent.
- 3) Molecular sieves as moisture adsorbents.

It was not feasible to evaluate formulations using every available zinc dust and additive. Also, it is difficult to determine by analytical methods whether or not a manufacturer used an exact specified material. Therefore, the salt spray performance requirement should be changed so that only those zinc primers that have been carefully formulated and manufactured would be acceptable.

During this study it was additionally noted that some formulations, both commercial and laboratory, performed satisfactorily in the salt spray test for considerably more than 1000 hours. This indicates that a properly formulated paint might perform well for 2000 hours.

### IMPLEMENTATION

The salt spray performance in the specification for organic zinc primer used to prime blast-cleaned structural steel will be changed to the following requirement.

#### Salt Spray Tests and Requirements

A 6 in. x 12 in. (152 mm x 305 mm) steel panel, ASTM D609, shall be blast-cleaned to white metal, coated with a 3-4 mil

total dry film thickness of the primer in two applications, and dried for 7 days at  $75^{\circ}\pm 2^{\circ}\text{F}$  ( $24 \pm 1^{\circ}\text{C}$ ) and 50%  $\pm 5\%$  relative humidity.

The prepared panel shall then be scribed to bare steel, ASTM D1654, and subjected to salt spray testing, ASTM B117, for 1,000 hours.

After 1,000 hours exposure, the coating shall be carefully solvent-stripped from one-half of the test panel and the entire panel evaluated according to ASTM D1654. *even if scribe rusting*

There shall be no underfilm corrosion from the scribe (rating of 10) and there shall be no corrosion spots or other surface defects on the unscribed areas (rating of 10).

#### DISCUSSION

Because enforcement of the salt spray requirement in the specification would cause nearly a two month delay for approval of the primer, prequalification or other quality assurance methods may have to be utilized to expedite the acceptance of the primer for use.

#### TEST RESULTS

Various laboratory formulations of an organic zinc-rich primer were made based upon the compositional formulation of current State Specification 8010-51J-36, Type I. The formula specification is shown in Figure I. The different formulations did not alter the resin, solvent, or pigment binder ratio and all conformed to the minimum compositional

requirements of the specification. The changes were made only in the type of zinc dust, suspending agent, and moisture control materials. Table I lists the different materials used in the formulations and a brief description of them as provided by the manufacturer.

Each completed primer was applied to steel test panels in two applications, one day apart, to give a total dry film thickness of 3 to 4 mils. The steel test panels used corresponded to ASTM D609, but were additionally prepared by abrasive blasting to a surface roughness of approximately 1.5 mils. The primed test panels were allowed to dry for 7 days at room temperature (approximately 75°F and 50% RH) before being cross-scribed to bare steel and tested in salt spray according to ASTM B117. Photographs of three test panels that have been partially solvent stripped to bare steel after salt spray exposure are shown in Figures II, III, and IV. These photos are representative of primers, having good and poor salt spray performance after 1100 hours.

Another set of test panels was prepared in the same manner except that the panels were solvent-degreased unblasted steel panels corresponding to ASTM D609 Type I, providing a relatively smooth surface.

Performance of the various primers on the abrasive blasted panels after 1,000 hours in ASTM B117 salt spray is shown in Table II. With but one exception, Pb15B, the primers formulated with higher metallic zinc dust, Aerosil R972 suspending agent, and a molecular sieve for moisture control, gave excellent performance with no white deposits, blisters, underfilm rust, or undercutting at the scribe lines. The one exception in the above group, however,

still had superior performance when compared to all the other formulations where white deposits, blisters, under-film corrosion, and undercutting at the scribe line were present in various degrees.

The salt spray performance of the primers evaluated on unblasted panels correlated well with those on the abrasive blasted panels, however, the test appeared much more severe for the primers on smooth steel. Some of the primers failed completely in less than 24 hours with large blisters and rust, while others were able to withstand over a week in the salt spray and still performed satisfactorily. At the present time, it seems that, with additional investigation, it may be possible to use ASTM D609 Type I panels with only solvent cleaning as a rapid screening test for the performance of organic zinc primer.

#### Suspension and Moisture Control and Salt Spray Resistance

The various materials used for the purpose of suspending pigments and controlling moisture in the primer all seem to perform adequately. Some formulations were stored for over a year with no settlement of the pigment or indication of gas formation in the sealed container. Differences, however, were obvious, as shown in Table II, when the various materials were used in making zinc primers and the performance evaluated by the ASTM B117 salt spray test for 1,000 hours.

## Specification

8010-61J-36

## Paint Primer; Zinc Rich Organic Vehicle Type

## Composition:

Pigment Ingredients  
(62.3 Percent of Composition Weight, Minimum)

<u>Parts by Weight of Pigment</u> <u>Type I, Red Tint</u>		
Zinc Dust	TT-P-460, Type I, *1	95.0 min.
Red Iron Oxide, *2		1.5 max.
Zinc Oxide	TT-P-463, Type I, Grades A or B	----
Thixotropes and Additives		3.5 max.

Vehicle Ingredients  
(37.7 Percent of Composition Weight, Maximum)

<u>Parts by Weight</u> <u>of Vehicle</u>		
Polyaryl Ether, *3		19.0
Ethylene Glycol Monoethyl Ether Acetate	MIL-E-7125	66.8
Toluene	TT-T-548	14.2

\*1 Except the metallic zinc content shall be 95 percent by weight, minimum.

\*2  $\text{Fe}_2\text{O}_3$  98.5% minimum; oil absorption, 21; fineness through 325 mesh screen, 99% minimum; and specific gravity, 5.15.

\*3 A polyhydroxy polyalkaryl polyether of the following properties:

Specific gravity	1.18
Viscosity of 40% solids in methyl ethyl ketone, Brookfield rvf, 20 rpm No. 5 spindle	5,500 to 7,700 cps
Reduced viscosity (0.2 g/100 ml. dimethylformamide)	0.4 to 0.6
Ultimate tensile strength	9,000 to 9,500 psi
Ultimate tensile elongation	50 to 100%
Softening temperature	212°F
Bulking value	0.102 gal. per lb.

The average particle size of the pigment shall not exceed 9 microns as determined by the Fisher Sub-Sieve Sizer. The Red Iron Oxide must first be ground into a portion of the vehicle to provide a Hegmen grind sufficient to produce the specified color of the finished paint.

The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

TABLE I

Zinc Dust	% Metallic Zn	CaO	% Through 325 Mesh	Average Particle Size
N. Jersey #22	96.6	.40	98	8 microns
" #422	95.6	.40	99.3	5.6 "
" #44	97.0	0	98	8 "
" #64	95.0	0	100	4.3 "
Pacific Regular	96.3	0	97.5	7.5 "

Suspending Agent	Manufacturers Description	Wt % In Formula
AEROSIL R972	Chemically treated hydrophobic colloidal silica	1.0, 1.2, 1.5
CABOSIL M-5	Fumed colloidal silica	1.0
THIXATROL ST	Organic derivative of castor oil	0.3
THIXATROL GST	Inorganically modified derivative of castor oil	0.4
MPA 60	Only described as organic in nature	1.0
BENTONE 38	Organic derivative of montmorillonite clay	0.3
CRAYVALLAC S.F.	Castor oil base	1.0
Aluminum Stearate	Stearic acid aluminum salt	1.2
MOISTURE CONTROL	Manufacturers Description	Wt % In Formula
Sylloid ZN-1	Molecular sieve	1.0
Sylloid 74	Amorphous silica gel	1.0
LINDE 4A	Molecular sieve	1.0
CALCIUM OXIDE	CaO	1.0

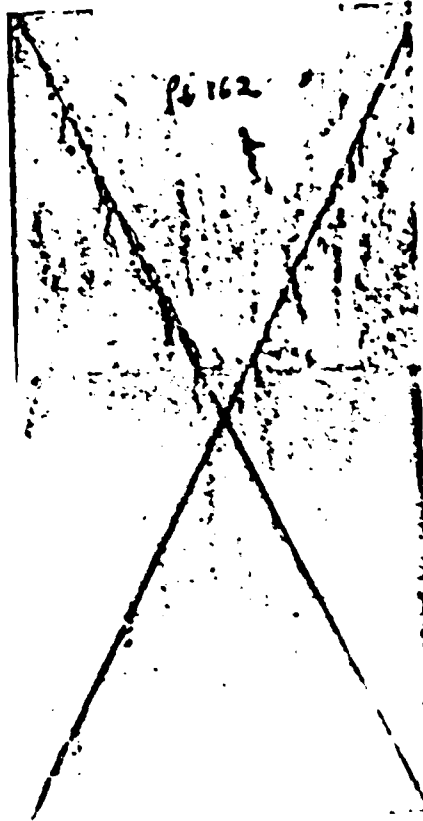
Figure 11



Pb 171  
Good Performance



Figure III



Pb 162  
Poor Performance

Figure IV



Pb 164  
Very Poor Performance

TABLE II

FORMULATION Number 151 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173

<u>TYPE ZINC</u>																					
<u>N. Jersey</u>																					
#22	x		x	x																	
#422		x																			
#44						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
#64																					
<u>Pacific Regular</u>																					
<u>Suspending Agent</u>																					
AEROSIL R 972	x	x	x	x	x	x	x	x													
CABOSIL M-5																					
THIXATROL ST																					
THIXATROL GST																					
BENTONE 28																					
CRAVALLAC SF																					
ALUMINUM STEARATE																					
<u>H<sub>2</sub>O CONTROL</u>																					
Sylold ZN-1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sylold 74																					
LINDE 4A																					
CALCIUM OXIDE																					
<u>SALT SPRAY</u>																					
White Deposits	x																				
<u>BLISTERS</u>																					
Under Film Rust																					
Scribe Undercut	x																				

STATE OF CONNECTICUT

DEPARTMENT OF TRANSPORTATION



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P. O. Box 207 (280 West Street)  
Rocky Hill, Connecticut 06067

October 1, 1979

3 OCT 1979 P.M.

Dr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Dr. Ordway:

Subject: Specification for Zinc-rich Paints or Primers

In response to your letter of September 19, 1979, please be advised that the Connecticut Department of Transportation does not have a specification for zinc-rich paints or primers.

Very truly yours,

*L. P. Perricone*

Louis P. Perricone  
Chief, Materials Testing Section  
Bureau of Highways



STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
P.O. BOX 778  
DOVER, DELAWARE 19901

PHONE (302) 678-4301

October 3, 1979

Artech Corp.  
2901 Telestar Ct.  
Falls Church, Virginia 22042

Attention Mr. Fred Ordway

Gentlemen:

Attached please find a copy of the inorganic zinc-vinyl topcoat paint system currently used by the Delaware DOT for protection of structural steel. This system has been in use for about 7 years with good success.

If additional information is needed, please contact us.

Yours very truly,

DIVISION OF HIGHWAYS

*Alfred D. Donofrio*  
Alfred D. Donofrio  
Materials & Research Engineer

PP  
Attach.

## SECTION 606-STEEL STRUCTURES CLEANING AND PAINTING

Subsections 606.48 thru 606.51 of the Standard Specifications shall be deleted and the following substituted:

**General Conditions.** The painting of metal structures shall include the proper preparation of the metal surfaces, the application, protection, and drying of paint coatings, the protection of pedestrians, vehicular, or other traffic upon or underneath the bridge structure, the protection of all portions of the structure against disfigurement by spatter, splashes, and smirches of paint materials, and the supplying of all tools, tackle, scaffolding, labor, and materials necessary for the work.

The following specifications provide for the coating of all steel surfaces of bridges with a prime coat consisting of self-curing inorganic zinc paint and a topcoat as specified herein. The inorganic zinc silicate systems shall be commercially available and of a type used by industry in actual applications on exposed steel structures.

The prime coat shall be applied at the steel fabricator's shop, in accordance with the procedure recommended by the paint manufacturer and the surface preparation requirements specified herein. The topcoat may be applied in the shop or in the field after erection. If applied in the shop a supplemental tie coat between the prime coat and topcoat may be required depending on the painting manufacturer's requirements. Areas of steel damaged by handling, shipping, erecting, concreting operations, or other means shall be recoated after proper surface preparation in accordance with the procedure recommended by the paint manufacturer. The touch up painting must meet the requirements of this specification and shall match the initial coating of the surrounding steel.

Before fabrication of the structural steel begins there shall be a meeting of the appropriate parties involved which shall be known as the "Post-Award Painting Conference."

Present at the meeting shall be:

- a. Engineer for steel inspection and his coatings specialist.
- b. General contractor.
- c. Paint and coating material supplier including local technical and sales representatives plus any other experienced personnel.
- d. Division of Highways personnel.

The purpose of the meeting is to discuss in detail the specifications, and the painting and coating work conforming to Product Data Sheets and Application Instructions available from the material supplier.

The discussions shall include:

- a. Equipment use and servicing.
- b. Material storage.
- c. Application Techniques (including thickness tolerances).
- d. Definition of the degree of cleaning, i.e., Steel Structures Painting Council Pictorial Standards or Maryland Pictorial Standards for Metallic Shot Blasting.
- e. Surface preparation of shop-primed surfaces whether by shotblasting or sandblasting, describing abrasive to be used, necessary air pressure at the blast nozzle, etc.
- f. Inspection requirements including surface preparation, wet and dry film thickness checking, techniques and equipment to be used.
- g. Inspection Reports.

All work shall be performed in accordance with the manufacturer's printed instructions, and the paint proposed by a manufacturer must conform to these specifications. All phases of the work shall be available to inspection by the Engineer.

Safety precautions stated in the manufacturer's printed instructions shall be carefully observed.

General Requirements:

1. Surface Preparation:

Weld splatter shall be removed and rough edges ground. All surfaces to be coated shall be blast cleaned in accordance with SSPC-SP10 (near white blast cleaning) so as to remove all surface mill scale, rust, old paint, dirt or other contaminants, and produce a uniform anchor pattern in the steel not to exceed .002" (2 mils). If sand or grit is used, the surface shall conform to SSPC Pictorial Standard Sa 2 1/2. When shot is used the surface shall conform to the Maryland Pictorial Standards for "Near White". Sand, grit, or shot used for surface preparation shall be in accordance with SSPC-SP10.

The fabricator shall demonstrate to the satisfaction of the Engineer that the anchor pattern obtained is in substantial conformance with the established limits.

Blasted surfaces shall not be left overnite prior to coating, and no coating shall be applied over surface upon which rust bloom has formed after cleaning. All sand and dust must be removed from the surface prior to coating.

## 2. Coating Application:

Coverage rates indicated herein are minimum but maximum rates are allowable. Refer to film thickness requirements.

All equipment shall be maintained in good working order, and shall be comparable to that described in the printed instructions of the coating manufacturer. All equipment shall be thoroughly cleaned before and after use with the appropriate cleaning solvents as indicated by the coating manufacturer.

Minimum interval between coat drying and curing time shall be required as described in the printed instructions of the coating manufacturer.

Except where otherwise specified, thinning shall be done only if necessary for workability of the coating material and then in accordance with the manufacturers printed instructions.

## 3. Mixing Instructions:

The inorganic zinc requires mixing before use. It is supplied in two containers, one of which contains the powder, the other a reactive liquid. Mix the powder slowly into the liquid with thorough stirring. Stir the mixture until the powder is well dispersed and then pass the mixture through a 30-60 mesh screen to remove any large zinc particles.

Thinner shall be used only in accordance with printed instructions.

## 4. Applications of Inorganic Primer:

Apply the inorganic zinc by spray in an even wet film. Seams, welds, corners, rivets, and rough spots should be given special attention to be sure they are covered. Minimum dry film thickness of the inorganic primer is 3 mils (.0030"). A dry film thickness in excess of 3 mils is allowable provided cracking or checking does not occur.

Faying surfaces shall receive a coat of the inorganic primer. The tops of flanges normally in contact with concrete shall receive a "dust coat" not to exceed 3/4 mils (.00075") to prevent rusting during storage and erection.



## 5. Inspection of Prime Coat

The Inspector or Engineer shall approve all surface preparation before the application of any coating. Each coat shall be inspected prior to application of the next coat. Areas found to contain runs, overspray, roughness, or other signs of improper application shall be repaired or recoated in accordance with the manufacturer's recommendations.

The minimum dry film thickness of the inorganic primer shall be no less than 3 mils (.0030") without cracking or checking.

## 6. Materials Specifications-Primer

### a. Zinc Pigment

The zinc portion shall be a finely divided zinc powder containing a minimum of 94 percent metallic zinc and 98 percent total zinc by weight (reference ASTM D520 Type II).

### b. Vehicle-Alkyl or Ethyl Silicate, solvent type, self-curing.

% Nonvolatile @ 105°C, by wt.	19.0 min.
% Silicon Dioxide, by wt. of vehicle	9.0 min.
Weight per gallon, pounds @ 77°F.	7.5 min.

### c. Properties of Mixed Paint

Weight per gallon,	21.0 min.
Viscosity, KU @ 77°F.	60-90
Percent Zn in the dry film, by wt.	75.0 min.
Weight of zinc gallon, pounds	14.6 min.
Dry Time- To touch, minutes	30 max.
To Topcoat, hrs.	24 max.
Pot Life @ 70°F, hrs.	8 min.

The color of the inorganic zinc primer must be such that a definite contrast between it and the color of the blasted steel is readily apparent. The contractor will be required to submit color samples of the primer to the Engineer for approval.

## 7. Materials Specification-Topcoat

The vinyl topcoat shall be a ready mixed vinyl chloride copolymer paint specifically formulated for use on steel structures which have been painted with inorganic zinc primer. To insure compatibility, both the primer and topcoat shall be supplied by the same manufacturer.

### Properties of Mixed Paint

Weight per gallon, lbs.	8.5 min.
Viscosity, KU @ 77°F.	65-95
% Non volatile, by wt.	35.0 min.
% Pigment, by wt.	12.0 min.
Dry Time-To touch, minutes	30 max.
To recoat, hrs.	4 max.
Gloss	Matte
Color-Federal Standard No. 595	24172

### 8. Application of Vinyl Topcoat

The application of the vinyl topcoat shall be by spray in an even wet film. The coating applied shall deposit a uniform dry film, without sagging or running, of sufficient thickness to produce a coating system (primer and topcoat) totaling not less than 7.0 mils. (.0070"). However, in no case will less than 3 mils. (.0030") of vinyl topcoat be accepted regardless of the thickness of the inorganic primer.

9. Before approval and use of the inorganic zinc and vinyl materials, a one-quart sample of each as well as a notarized test report from the material supplier shall be submitted to the Delaware Department of Highways and Transportation as proof of conformance to the quantitative requirements and performance tests. The Engineer reserves the right to sample and test all materials. The Engineer or his representative, shall have access to the manufacturer's facilities for the purpose of sampling the material as deemed necessary, subsequent to granting approval for acceptance of such materials.

### Basis of Payment:

Payment for cleaning and painting shall be included in the lump sum price bid for Section 606, Steel Structures, which price and payment shall constitute full compensation for furnishing all materials and for performing all work described herein, and as directed by the Engineer, and for all labor, equipment, tools, and incidentals necessary to complete the work.



STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

MAILBOX  
DISTRICT

To: *22 Fred Ordway*

From: *F. H. Ramsey*  
Date: *9-24-79*

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☐ SEE ME  
☐ REPLY  
☐ my signature  
☒ AS REQUESTED  
☐ APPROVE  
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☐ return  
☐ circulate  
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SEN. C. 10/10

4 OCT 1979

#### 971-14 Galvanizing Compound (Organic Zinc-Rich Coating) for Field Metalizing and Touchup Repair.

##### 971-14.1 Composition and Proportions:

Galvanizing compound for the metalizing of welded areas and for repairing of damaged galvanized areas shall consist of at least 80 per cent pigment and not more than 20 per cent vehicle, and shall meet the following composition requirements for each.

##### Composition of Pigment:

Zinc dust (Fed. Specs. TT-Z-291) . . . . . Min. 99.0%  
Dust (Metallic Zinc Powder) . . . . .

Type I Lead Suboxide Stabilizer . . . . . Max. 0.15%

##### Composition of Vehicle:

Non-Volatile vehicle . . . . . Min. 22.0 per cent  
Volatile vehicle . . . . . Max. 78.0 per cent

The non-volatile portion of the vehicle shall be composed of chlorinated rubber, together with suitable plasticizer. The chlorine content, based on the non-volatile vehicle, shall be a minimum of 60 percent by weight.

The volatile portion of the vehicle shall be completely compatible with the other ingredients of the finished product and shall yield a product conforming to all physical and chemical properties required for the end product.

##### 971-14.2 Physical Properties:

(a) The weight per gallon of the finished product shall be at least 22 pounds.

(b) The viscosity of the compound, when measured at 77°F, shall be 90-130 Krebs units (as measured by the Stormer Viscosimeter).

(c) There shall be no appreciable gassing or pressure build-up in the container when material is stored at room temperature for a three-month period.

(d) The pigment component of the ready-mixed compound shall not settle when the package remains unopened for a period of one year, to the extent that it cannot be readily dispersed by hand mixing. The liquid vehicle shall not liver, curdle, or show excessive bodying.

##### 971-14.3 Application, Drying, etc.:

971-14.3.1 *Application:* The material shall be capable of being applied in the manner specified, without undue difficulty, in horizontal, vertical or overhead positions, such as would be required in the repairing of galvanized areas or in the galvanizing of welds.

971-14.3.2 *Drying Time:* The compound shall set to touch in 30 minutes and shall be dry to re-coat in 4 hours. It shall be thoroughly hard within 48 hours after application.

971-14.3.3 *Dry Film Thickness:* When the compound is applied according to the field application specifications a dry film thickness of 2 mils minimum and of 3 mils maximum shall be established.

971-14.3.4 *Adhesiveness:* Test panels coated according to the field application specifications shall be exposed to the weather for a period of at least three months, in a position of 45 degrees to vertical, facing south. At the end of this period, the test panels shall show no visible signs of peeling or of flaking.

971-14.3.5 *Hardness:* After the test panels coated under these testing requirements have been allowed at least 48 hours of drying and curing, a section shall be hand-wire brushed. This brushing shall be continued until a bright metallic appearance has developed. The brushing shall not cause the film to become thinner than the specified dry film thickness.

##### 971-14.4 Packaging and Storing:

For containers of less than one gallon in content, commercial paint packaging will be acceptable. For one-gallon packages, 26-gage steel pails shall be used. Not more than one gallon of compound covered by these specifications shall be packed in a single container.

The compound shall be stored in a location where the temperature does not drop below 45°F.

971-14.5 *Test Requirements:* Certified copies of manufacturer's tests, certifying that the material meets the above specifications, may be accepted in lieu of tests by the Department.

#### 971-15 Self-Curing Inorganic Zinc Coating.

##### 971-15.1 Materials:

971-15.1.1 *General:* Unless approval is obtained for an unlisted self-curing inorganic zinc rich coating system by complying with the requirements as specified in 971-15.2 below, the particular coating system used shall be one of those named on the Department's approved list of qualified products (current at the time required for use) maintained by the Office of Materials and Research at Gainesville.

##### 971-15.1.2 *Conditions of Listing Qualified Products:*

This inclusion of a particular coating system on the list of qualified products indicates that the coating system has been given contingent approval after being subjected to such tests as the Department believes necessary to demonstrate that the coating system is satisfactory for the protection of steel from corrosion.

This Department reserves the right to remove any material from the approved list at the direction of the State Materials and Research Engineer.

**971-15.1.3 Certification of Tests:**

The producer of the paints described in this Section shall furnish to the Department three copies of a certified report outlining the paint composition characteristics specified in 71-15.2.2 and the results of the physical tests specified in 1-15.2.3.1 and 971-15.2.3.2. Final acceptance, however, will be based on test results of samples obtained after delivery of the paint to the job site. The test results must conform to the values and tolerances obtained for the products when they were initially qualified. The quality control field sample tests performed by the Department's Central Laboratory shall include the following:

- (1) Infrared identification curves for zinc coating vehicle component, the intermediate coat vehicle component and the finish coat vehicle component.
- (2) Weight per gallon at 77 degrees F for the mixed zinc primer coat, the intermediate coat and the finish coat.
- (3) Viscosity in Krebs Units at 77 degrees F for the mixed zinc primer coat, the intermediate coat, and the finish coat.
- (4) Weight percent volatile liquid of the mixed zinc primer coat, the intermediate coat and the finish coat.
- (5) Weight percent of metallic zinc in the cured zinc primer coat dry film.
- (6) Weight percent of metallic zinc in the zinc pigment component.
- (7) Pot life of the mixed zinc primer.

**971-15.2 Testing:****971-15.2.1 General:**

Manufacturers or distributors seeking approval of self-curing inorganic zinc coating systems for inclusion on the qualified products list shall comply with the requirements specified below.

Approval will be granted for qualifying products upon submission of the required samples and information and after tests have verified that those products submitted for a particular coating system are satisfactory.

**971-15.2.2 Information to Accompany Samples:**

Products submitted for approval shall be accompanied by a notarized letter giving the following information:

- (1) Copies of the infrared curves (2.5 to 15 microns) for the zinc coating vehicle component, the intermediate coat vehicle and the finish coat vehicle.
- (2) Weight per gallon at 77 degrees F for the mixed zinc primer coat, the intermediate coat and the finish coat.
- (3) Viscosity in Krebs at 77 degrees F for the mixed zinc primer coat, the intermediate coat, and the finish coat.
- (4) The theoretical number of square feet that can be

covered per gallon to a dry film thickness of one mil for the mixed zinc primer coat, intermediate coat, and the finish coat.

(5) Total volume solids (Volatile Measurement Method) of the mixed zinc primer coat, the intermediate coat and the finish coat.

(6) Generic classification of the mixed zinc primer coat, the intermediate coat and the finish coat.

(7) Weight percent solids of the generic classified components for the zinc primer intermediate and finish coat vehicles.

(8) Weight percent volatile liquid of the mixed zinc primer coat, the intermediate coat and the finish coat.

(9) Weight percent of metallic zinc in the cured zinc primer coat dry film.

(10) Pot life of the mixed zinc primer.

(11) Weight percent of metallic zinc in the zinc pigment component.

The manufacturer shall also include, for the products submitted, complete application and thinning instructions. All samples and information shall be directed to the Department of Transportation, State Materials and Research Engineer, Gainesville, Florida 32601.

**971-15.2.3 Tests:****971-15.2.3.1 RESISTANCE TESTS:**

Test panels for the test described below shall be prepared by applying the inorganic zinc primer to near white metal blasted steel coupons (SSPC-SP10-63, 1 to 1.5 mil profile) and allowing to dry for 24 hours at 77 degrees F and 50% RH. The dry film thickness of the coating shall be not less than 3 mils nor more than 5 mils.

(1) When tested for abrasion resistance in accordance with Federal Standard 141a, Method 6192, using CS-17 wheels and a 1000-gram load per wheel, the cured coating shall show a maximum loss of 0.2 gram per thousand cycles.

(2) The cured coating shall show no loss of adhesion or hardness and shall display no flaking or cracking when held at 600 degrees F for three hours.

(3) The cured film shall show no flaking, blistering, cracking or loss of adhesion after being wrapped in two 1/2 inch thick layers of cotton wadding and saturated with tap water for eight hours.

(4) The cured coating, diagonally scribed to expose bare steel, when tested for salt spray resistance in accordance with Federal Standard 141a Method 6061, shall show no corrosion after 1000 hours of test. The corrosive medium shall be a five percent sodium chloride solution.

(5) The cured coating, diagonally scribed to expose bare steel and exposed to flowing tap water at 73 degrees F,

shall show no scribe corrosion, blistering, loss of adhesion, or cracking after 1000 hours test. Test panels shall be completely immersed in a suitable container of at least five gallons capacity with fresh water inlet and outlet which will accomplish water change at a rate not less than 15 gallons per hour.

(6) The cured coating, diagonally scribed and completely immersed for four weeks at 73 degrees F in a three percent solution of aerated synthetic sea water ("Sea Salt," Lake Products Co., St. Louis, Missouri), shall show no scribe corrosion, blistering, cracking, or loss of adhesion. Aeration shall be accomplished by bubbling compressed air into the solution at a rate sufficient to accomplish moderate agitation of the liquid. At least five gallons of solution shall be used in performing this test.

#### 971-15.2.3.2 ADHESION TESTS:

Test panels consisting of the zinc primer coat plus the tie coat, the zinc coat plus the finish coat; and the zinc primer coat plus the tie and finish coats shall be subjected to the adhesion tests described below. The zinc primer coat shall be applied as specified in 971-15.2.3.3. The tie coat application on the zinc primer-tie coat panel and the zinc primer-tie coat finish coat panel shall have a dry film thickness of 1.0 to 2.0 mils. The finish coat application on the zinc primer-finish coat panel and the zinc primer-tie coat-finish coat panel shall have a dry film thickness of 3.0 to 5.0 mils. Drying of the tie coat and the finish coat application shall be done at a temperature of 77 degrees F and relative humidity of 50 to 85 percent. All of the prepared panels shall be allowed to dry a minimum of 72 hours before proceeding with the adhesion tests.

(1) No chipping, flaking or peeling of the tie coat or finish coat shall occur when cross hatches 1/16 inch apart are cut in all of the test panels.

(2) When all of the test panels cross hatched in the manner described above are tested with the point of a knife blade, no lifting of the tie coat or finish coat shall occur.

(3) Adhesion of the tie coat to the primer shall not be decreased upon application of the finish coat, and adhesion tested by knife-point shall be equivalent to that observed with the tie coat alone over the primer.

#### 971-15.2.3.3 FIELD QUALIFICATION:

Manufacturers or distributors seeking approval of the self-curing inorganic zinc coating systems shall demonstrate the application characteristics of their products by painting approximately 500 square feet of steel girders under a bridge selected by the Department which shall be located in a coastal salt water environment zone. The recommended zinc primer shall be applied over the entire area to be painted. A one-third section of the primed area shall be painted with tie coat and finish coat (Three Coat System). Another one-third section of

the primed area shall be painted with finish coat only (Two Coat System). The field demonstration shall include the following:

(1) Steel surfaces shall be blast cleaned using 30 x 65 mesh silica sand to a "Near White" condition as defined in SSPC-SP10-63. The "Near White" blast condition shall be determined by use of N.A.C.E. No. 2 Visual Standard TM-01-70 or equal approved by the Department. After blast cleaning, the anchor pattern shall be from one to two mils deep in a dense and uniform pattern of depression and ridges as determined by use of the Keane-Tator Surface Profile Comparator or equal approved by the Department.

(2) The zinc primer coat shall be applied as recommended by the manufacturer in a single application employing multiple spray "passes" to achieve a dry film thickness of three to five mils above the anchor pattern. The dry film thickness shall be determined by use of an Inspector Magnetic Dry Film Thickness Gage or equal approved by the Department. Prior to use, the magnetic dry film thickness gage shall be calibrated with N.B.S. No. SRM 1362 certified coating thickness calibration standards. The applied coating shall be considered deficient in thickness if the measured values are found to be less than three mils plus 30 percent of the anchor pattern depth obtained during the abrasive cleaning operation. Products which cannot be applied to build a dense and uniform coating shall be considered unacceptable by the Department. Products which exhibit "mudcracking" after curing shall also be considered unacceptable by the Department. The zinc primer coat shall be allowed to dry a minimum of 24 hours before application of the tie coat or finish coat.

(3) The intermediate tie coat shall be applied in a single application employing multiple spray passes to achieve a dry film thickness of 1.0 to 2.0 mils. The color of the tie coat shall contrast with both the color of the primer coat and the color of the finish coat.

(4) The finish coat shall be applied as recommended by the manufacturer in a single application employing multiple spray "passes" to achieve a minimum dry film thickness of three mils. The color of the finish coat shall contrast with both the color of the primer coat and the color of the intermediate coat. Finish coat products which exhibit "bubbling" or a non-uniform appearance after drying shall be considered unacceptable by the Department.

(5) The Department shall obtain a one quart field sample of each product included in the application for subsequent laboratory examination by the Department's Central Laboratory.

(6) Each of the applied coating systems shall remain exposed to weathering for a period of three years at which

time there shall be no evidence of blistering, cracking, peeling, or loss of adhesion between coats and there shall occur not more than one percent of area rusting in each of the test sections painted.

**971-15.2.3.4 CERTIFICATION:** Products submitted for approval must include a notarized copy of a test report directed to the address specified in 971-15.2.2) recording the results of tests specified in 971-15.2.3.1 and 971-15.2.3.2.

## EROSION CONTROL MATERIALS

### SECTION 981 GRASSING AND SODDING MATERIALS

#### 981-1 Seed.

Unless other types of seed are called for in the plans or special provisions, permanent type grass seed shall be a mixture of 20 parts of bermuda seed and 80 parts of Pensacola bahia seed. Quick-growing type grass seed shall be a species which will provide an early ground cover during the particular season when planting is done and will not later compete with permanent grass. The separate types of seed used shall be thoroughly dry-mixed immediately before sowing. Seed which has become wet shall not be used.

The bermuda seed shall be an equal mixture of hulled and unhulled seed. The Pensacola bahia seed shall be scarified seed, having a minimum active germination of 40 per cent and a total germination of 85 per cent. All seed shall meet the requirements of State Department of Agriculture and Consumer Services and all applicable State laws, and shall be approved by the Engineer before being sown.

#### 981-2 Sprigs.

Unless a particular type of sprig is called for in the plans or special provisions the sprigs used shall be either bermuda, St. Augustine, or centipede. Only one type of sprig shall be used within any one-mile section of the road.

Sprigs shall be harvested with approved implements, in such manner that at least three inches of root system shall be lifted intact.

The sprigs shall be of suitable size and character and shall be live, fresh, healthy, and uninjured, at the time of planting.

#### 981-3 Sod.

**981-3.1 Types:** Unless a particular type of sod is called for, and may be of either centipede or bahia grass, at the Contractor's option. It shall be well matted with roots. Where sodding will adjoin, or be in sufficiently close proximity to, private lawns other types of sod may be used if desired by the affected property owners and approved by the Engineer.

**981-3.2 Dimensions:** The sod shall be taken up in commercial-size rectangles, preferably 12-inch by 24-inch or larger, except where 6-inch strip sodding is called for.

### 60-15 Method of Measurement.

The quantities to be paid for under this Section shall be determined under one of the following conditions.

(a) When no pay item for painting structural steel is included in the proposal, the work specified in this Section will not be paid for directly but will be considered as subsidiary work pertaining to the various items of construction in which paint is applied.

(b) When a pay item for painting structural steel is included in the proposal, the work specified under this Section shall be paid for at the contract lump sum price, or the contract price per ton, for Painting Structural Steel. Under this condition the quantity measurement shall be either the lump sum quantity quoted and accepted, or the number of tons of structural steel, actually painted and accepted.

### 60-16 Basis of Payment.

When there is no item for painting structural steel included in the proposal, the work specified in this Section shall be included in the payment for the applicable items under Section 460. When an item for painting structural steel is included in the proposal, the quantities shall be determined as provided above and shall be paid for at the contract lump sum price, or the price per ton, for Painting Structural Steel. Painting Structural Steel shall include the painting of structural steel, machinery and castings, steel grid floors and steel endrill. Such price and payment shall be full compensation for all work specified in this Section.

Payment shall be made under:

Item No. 560-1—Painting Structural Steel—lump sum.

Item No. 560-2—Painting Structural Steel—per ton.

## SECTION 561 SELF CURING INORGANIC ZINC COATING SYSTEMS

### 61-1 Description.

The work specified in this Section is the procedure required for the shop, field and maintenance painting of structural steel using proprietary inorganic zinc coating materials meeting the requirements of 271-15.

The provisions of Section 560 not in conflict with this section shall also apply.

Self-curing inorganic zinc coating systems are classified into two systems of application and locality of use as follows:

1. Self-Curing Inorganic Zinc Coating System (TWO COATS)—For inland non-chemical exposure use.
2. Self-Curing Inorganic Zinc Coating System (THREE COATS)—For coastal use including brackish salt water areas, and other locations where the plans indicate the presence of a corrosive environment.

TWO COAT SYSTEM shall be comprised of a self-curing inorganic zinc primer application and finish coat application. The THREE COAT SYSTEM shall be comprised of a self-curing inorganic zinc primer application, an intermediate coat application and a finish coat application. The particular coating system to be used (TWO or THREE COATS), shall be as designated in 1 and 2 above.

### 561-2 Application.

#### 561-2.1 Shop Applied Self-Curing Inorganic Zinc Coatings:

Steel surfaces shall be blast cleaned with 30 x 65 mesh silica sand to a "Near White" condition as defined in SSPC-SP10-63. The "Near White" blast condition shall be determined by use of N.A.C.E. No. 2 Visual Standard TM-01-70 or equal approved by the Department. After blast cleaning, the anchor pattern shall be from one to three mils deep in a dense and uniform pattern of depressions and ridges as determined by use of a Keane-Tator Surface Profile Comparator or equal approved by the Department.

Surfaces within one inch of welded field connections shall be masked off at the time of shop painting.

For two component products, the powder component shall be added to the liquid component with thorough stirring, and stirring continued until the powder is well dispersed. The mixture shall then be strained through a 30-60 mesh screen to remove large particles. Pressure pots containing the mixed powder and liquid shall be equipped with a mechanical agitator which shall be in motion throughout the application period. The pressure pots shall be kept at approximately the same elevation as the spray gun.

The self-curing inorganic zinc coating shall be applied as recommended by the manufacturer in a single application employing multiple spray "passes" to achieve a dry film thickness of three to five mils above the anchor pattern as determined by use of an Inspector Magnetic Dry Film Thickness Gage or equal approved by the Department. Prior to use, the magnetic dry film thickness gage shall be calibrated with N.B.S. No. SRM 1362 certified coating thickness calibration standards. The applied coating shall present a dense and uniform appearance after curing. The applied coating shall be considered deficient in thickness if the measured thickness values are found to be less than three mils plus thirty percent



of the anchor pattern depth previously determined after the abrasive cleaning operation. Areas found deficient from the minimum specified coating thickness shall be repaired according to the manufacturer's recommendations. Coated areas exhibiting "mudcracking" shall be repaired according to the manufacturer's written recommendations.

As required by the Engineer all areas inaccessible for sandblasting 1/2 inch wide or less, such as welded faying surfaces that do not have continuous welds, shall be sealed with a caulking compound which has been approved for use by the State Materials and Research Engineer.

Surfaces which are damaged, faulty, abraded, or which were not covered in the shop shall be cleaned by abrasive blasting to a near white surface finish and spot repaired with the self-curing zinc coating after erection and before application of any intermediate coats or finish coats.

The Engineer will inspect each section of steel before it is painted. The Contractor will furnish and erect scaffolding to the satisfaction of the Engineer in order to facilitate a safe inspection of all cleaned areas. If the area is approved for painting, the Contractor may then paint the area.

The above in no way shall relieve the Contractor from responsibility for faulty work that may show up or maintenance work that may be necessary during the life of the contract.

#### 561-2.2 Field Applied Self-Curing Inorganic Zinc Coatings:

Steel surfaces shall be blast cleaned with silica sand to a "Near White" condition as defined in SSPC-SP 10-63. The "Near White" blast condition shall be determined by use of N.A.C.E. No. 2 Visual Standard TM-01-70 or equal approved by the Department. After blast cleaning, the anchor pattern shall be from one to three mils deep in a dense uniform pattern of depressions and ridges as determined by use of a Keane-Tator Surface Profile Comparator or equal approved by the Department. Approval for use of abrasives other than silica sand must be obtained from the State Materials and Research Engineer.

For two component products, the powder component shall be added to the liquid component with thorough stirring and stirring continued until the powder is well dispersed. The mixture shall then be strained through a 30-60 mesh screen to remove large particles. Pressure pots containing the mixed powder and liquid shall be equipped with a mechanical agitator which shall be in motion throughout the application period. The pressure pot shall be kept at approximately the same elevation as the spray gun.

The self-curing inorganic zinc coating shall be applied as recommended by the manufacturer in a single application employing multiple spray "passes" to achieve a dry film

thickness of three to five mils above the anchor pattern as determined by an Inspector Magnetic Dry Film Thickness Gage or equal approved by the Department. The applied coating shall represent a dense and uniform appearance after curing. Prior to use, the magnetic dry film thickness gage shall be calibrated with N.B.S. No. SRM 1362 certified coating thickness calibration standards. The applied coating shall be considered deficient in thickness if the measured thickness values are found to be less than three mils plus thirty percent of the anchor pattern depth previously determined after the abrasive cleaning operation. Areas found deficient from the minimum specified coating thickness shall be repaired according to the manufacturer's written recommendations. Coated areas exhibiting "mudcracking" shall be repaired according to the manufacturer's written recommendations.

As required by the Engineer all areas inaccessible for sandblasting 1/2 inch wide or less, such as bolted faying surfaces and welded faying surfaces that do not have continuous welds, shall be sealed with a caulking compound which has been approved for use by the State Materials and Research Engineer. The caulking shall be applied prior to application on any intermediate coats or finish coats.

The Engineer will inspect each section of steel before it is painted. The Contractor will furnish and erect scaffolding to the satisfaction of the Engineer in order to facilitate a safe inspection of all cleaned areas. If the area is approved for painting, the Contractor may then paint the area.

The above in no way shall relieve the Contractor from responsibility for faulty work that may show up or maintenance work that may be necessary during the life of the contract.

**561-2.3 Intermediate Coat:** The intermediate coat shall be applied as recommended by the manufacturer in a single application employing multiple spray "passes" to achieve a dry film thickness of one to two mils. The color of the intermediate coat shall contrast with both color of the self-curing inorganic zinc coating and the color of the finish coat. The intermediate coat dry film thickness shall be determined by use of a Tooke Gage or equal approved by the Department.

#### 561-2.4 Finish Coat:

The finish coat shall be applied as recommended by the manufacturer in a single application employing multiple spray "passes" to achieve a minimum dry film thickness of three mils. The color of the finish coat shall contrast with both the color of the self-curing inorganic zinc primer coat and the color of the intermediate coat.

The finish coat dry film thickness shall be determined by use of a Tooke Gage or equal approved by the Department.

Additional thickness of coating may be required if the Engineer deems it necessary in order to insure a finish coat that is uniform in color and even in appearance.

The Contractor shall submit finish coat color chips for selection of color by the Engineer.

**561-2.5 Painting Conditions:** No paint shall be applied at a temperature below 40 degrees F. No paint shall be applied when the relative humidity is greater than 85 percent or when a combination of temperature and humidity conditions are such that moisture is condensing upon the surface to be painted.

**561-2.6 Additional Requirements for Maintenance Contracts:**

If any structural steel member is found to be defective and in need of replacement or repairs during the cleaning operation, the local Maintenance Engineer will arrange to have repairs started within twenty-four hours. The Contractor will cooperate with State Forces making these repairs. After repairs are completed the Contractor will clean and paint the repaired sections at no additional expense to the Department.

Electric motors and any other items to which sand blasting and spray painting may be detrimental shall be cleaned by wire wheel brushes or any other method satisfactory to the Department and brush painted.

The Contractor shall cover all motors, gears and electric apparatus that may be damaged by sand from the sandblasting. The bridge shall be kept free from sand buildups at all times.

The Contractor will be required to keep all moving parts of movable spans well greased in accordance with Department lubrication requirements and free of sand at all times.

### 561-3 Method of Measurement.

The quantities to be paid for under this Section shall be determined under one of the following conditions.

(a) When no pay item for painting structural steel is included in the proposal, the work specified in this Section will not be paid for directly but will be considered a subsidiary work pertaining to the various items of construction on which paint is applied.

(b) When a pay item for painting structural steel is included in the proposal, the work specified under this Section shall be paid for at the contract lump sum price, or the contract price per ton, for Painting Structural Steel. Under this condition the quantity measurement shall be either the lump sum quantity painted and accepted, or the number of tons of structural steel, actually painted and accepted.

### 561-4 Basis of Payment.

When there is no item for painting structural steel included

in the proposal, the work specified in this Section shall be included in the payment for the applicable items under Section 460. When an item for painting structural steel is included in the proposal, the quantities shall be determined as provided above and shall be paid for at the contract lump sum price, or the price per ton, for Painting Structural Steel. Such prices and payments shall be full compensation for all work specified in this Section.

Payment shall be made under:

Item No. 561-1—Painting Structural Steel—lump sum.

Item No. 561-2—Painting Structural Steel—per ton.

## SECTION 562 ZINC PAINT COATING

### 562-1 Description.

The work under this Section consists of the application of a zinc paint coating over welded areas of galvanized structural members and over areas of previously galvanized members on which the galvanizing has, in the opinion of the Engineer, become significantly damaged.

### 562-2 Materials.

The material used for the paint coating shall be a galvanizing compound as specified in 971-14.

### 562-3 Construction Methods.

Before the application of the compound the Contractor shall assure that the welded area or damaged spelter area is clean and free of grease. The area shall then be thoroughly brushed with a stiff wire brush until all dirt, loose galvanizing, welding slag, or other foreign material is removed. If necessary the area shall be cleaned with an approved grease-removing solvent. After the cleaning of the area, two coats of the galvanizing compound shall be applied smoothly and evenly, with a moderately filled paint brush. Application shall be made only when the temperature of the metal, of the compound, and of the surrounding air is above 45° F. On smooth surfaces, the minimum dry film thickness shall be two mils. On rough or pitted surfaces, the Engineer may require more than the specified two coats, if necessary in his opinion, in order to obtain acceptable cover. At least four hours drying time shall be allowed between coats. Brushing back over partly dried applications will not be permitted.

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION

JACK K. SUWA  
JAMES B. McCORMICK

HWY-TC  
2.53482

October 2, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

In response to your letter dated September 19, 1979, the Highways Division of the State of Hawaii specified the following paint systems:

1. Galvanized surfaces shall be prepared for painting by following the Pretreatment Specifications No. 3 Basic Zinc Chromate Vinyl Butyral Washcoat of the "Steel Structures Painting Council Handbook."
2. The primer shall be a zinc dust-zinc oxide primer meeting the requirements of Federal Specification TT-P-641.
3. Repainting of damaged galvanized shall be done by one of the following paints:

(a) Zinc dust- Zinc Oxide Paint	Federal Apecification MIL-E-1545
(b) Zinc dust primer coating	Federal Specification MIL-P-26815
(c) High zinc dust content paint	Federal Specification MIL-P-21035

If further assistance is needed, please do not hesitate to write.

Very truly yours,

  
T. ARATANI

Materials Testing & Research Engineer  
Highways Division

OCT. 1 1970

Sheet 1 of 5  
MP-78-1

INDIANA STATE HIGHWAY COMMISSION

SPECIAL PROVISIONS

CLEANING AND PAINTING STEEL STRUCTURES

14 OCT 1970 A.M.

These Special Provisions, in addition to the current Indiana State Highway Standard Specifications, are to become a part of this contract for cleaning and painting steel structures, and shall supersede any conflicting requirements of the Standard Specifications.

I. DESCRIPTION

This work shall consist of cleaning and preparing all surfaces to be painted, furnishing and applying all paint, the maintenance and protection of all pedestrian and vehicular traffic, and the protection of the structure and other property against damage that may result from the work.

The surfaces to be cleaned and painted shall include the surfaces of all steel members of the superstructure, substructure, floor beams, stringers, plates, castings, etc., and shall be cleaned as specified elsewhere herein.

II. CONSTRUCTION REQUIREMENTS

a) SEASONAL AND WEATHER LIMITATION:

Painting shall not be done between November 15, and April 1, nor when the temperature is below forty (40) degrees Fahrenheit. Paint shall not be applied when there is moisture or frost on the surfaces, nor when the air is misty, nor when the weather conditions, in the opinion of the engineer, are unsatisfactory for the work.

b) TRAFFIC PROVISIONS:

Traffic shall be permitted to use the roadway of these structures at all times, two lane traffic being maintained where at all possible. The roadway shall be restricted to one lane traffic when blast cleaning or painting a portion of a structure that is over the traveled roadway, or when, in the opinion of the engineer, the need exists.

During blast cleaning operations, provisions must be made by the contractor to protect existing traffic from any hazards resulting from the blast cleaning operations. The provisions shall include a type of barrier system which would protect against direct blasting of vehicles or pedestrians, eliminate abrasive materials and debris from falling on the traveled portions of the pavement, and prevent the spreading of abrasive materials and debris in the area which would create a traffic hazard. At the pre-construction meeting, the contractor must submit a plan detailing the method of protection to be used.

Whenever the intended purpose of the protective devices are not accomplished, work shall be suspended until corrections are made. In addition, any abrasive material and debris deposited on the pavement and shoulders in the working area must be removed.

The contractor's attention is directed to the fact that Standard Signs shall be furnished and placed in accordance with Standard Detour Sheets 1, 1A and 2, with the exception that "Bridge Painting Ahead Sign", as shown herein shall be used in place of "Road Construction Ahead Sign". Also, a "Flashing Arrow Board" will be required at structures indicated on the "Location of Work and Description" sheets.

The contract includes an item for "Maintaining Traffic", and the contract lump sum price bid for each structure will be payment in full for furnishing all the labor, materials and equipment required to maintain traffic.

c) RESPONSIBILITY FOR DAMAGE

The contractor shall protect pedestrians, vehicular and other traffic upon or underneath bridges, all portions of the bridge superstructure and substructure, and all adjacent property, against damage or disfigurement by spatters, splashes, and smirches of paint or paint materials. Similar protection shall be afforded any highway appurtenances that could be damaged by blast cleaning operations. The contractor shall be responsible for any damage caused by his operations to vehicles, persons or property.

d) PROSECUTION OF WORK

The contractor shall supply sufficient labor, materials, and equipment so that the work can be completed within the time specified in the proposal. Once the operation of cleaning and painting is begun, it shall be prosecuted on all acceptable working days without stoppage, until all work is completed. Attention is directed to the provision that NO WORK on cleaning or painting of bridges shall be done on Sundays, Memorial Day, Fourth of July, or Labor Day. When required by the engineer, the contractor shall submit a schedule indicating the sequence in which he proposes to paint the various structures when more than one is included in the contract, or shall submit his schedule for cleaning and painting operations on any structure.

e) SURFACE PREPARATION

Before application of any paint, all surfaces to be coated shall be thoroughly cleaned and properly prepared to the satisfaction of the engineer. Proper preparation will require that all surfaces be subjected to the cleaning methods specified herein after. All surfaces shall be inspected by the engineer before the applications of any coat.

Cleaning shall proceed by sections, bays, or other readily identifiable parts of the work approved by the engineer. The cleaning of each section, bay, or part of the work shall be entirely completed and inspected before any paint is applied. The alternate cleaning and painting of short sections by one workman will not be permitted.

Surfaces to be painted using PAINTING SYSTEM #1 shall be cleaned in accordance with "Steel Structures Painting Council, Surface Preparation Specification #7, Brush or Blast Cleaning". This finish is defined as one from which all oil, grease, dirt, rust, and loose paint or coatings are removed completely, but tight mill scale and tightly adhered rust, paint, and coatings are permitted to remain provided they have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface. Photographic or other visual standards of surface preparation may be used to further define the surface.

Surfaces to be painted using PAINTING SYSTEM #2 shall be cleaned in accordance with 619.03. The contractor's attention is brought to the fact that the cleaning shall rigidly conform to the "Structural Steel Painting Council" specification. Copies may be obtained from SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213.

If, in the opinion of the engineer, traffic or any other source produces an objectionable amount of dust, the contractor shall, at his own expense, allay the dust for a sufficient distance around the structure and shall take any other precaution necessary to prevent the dust and dirt from coming in contact with the cleaned or freshly painted surface.

All trash, debris, and other foreign substances shall be removed from pockets and crevices of truss spans and shall be cleaned from around bearing plates, shoes, etc. The entire surface of the beam or truss seat on each unit of the structures shall be cleaned.

f) STRIPING END POSTS

After the completion of the finish coat of green, the end batter posts of structures shall be painted with eight (8) inch alternate stripes at 45 to the horizontal, with white CODIT reflective liquid or equal and Black Field Paint. This striping shall be from the floor level on the end batter posts, upward to the connecting point of cross portal member. In the absence of cross members, the striping shall be from the floor level upward to a point whichever comes first, the top of the chord or a place on the chord that is twelve (12) feet vertically above the bridge floor. If there is a steel railing, the roadway face shall be given one coat of White Field Paint.

g) UNSATISFACTORY WORK

Paint work, at any stage of its completion, which is unsatisfactory, in the opinion of the engineer, shall be removed and the surface shall be cleaned and prepared again and repainted to the satisfaction of the engineer.

## h) MARKING

After the completion of the finish coat of green, and approved by the engineer, contractor shall stencil in two (2) inch black letters, at eye level PAINTED - M - (Contract No.) - (Date)

## i) STRUCTURAL STEEL

The estimated weight, length, and number of steel spans that are shown on the plans or in the proposal is an item of incidental information, and it shall be understood that this is approximate only and the Indiana State Highway Commission does not guarantee its accuracy.

## III. BASIS OF PAYMENT

This work will be paid for at the lump sum price bid for "Cleaning" and "Painting" for the structure or designated section of a structure which payment shall be full compensation for cleaning the surfaces, furnishing, transporting, necessary storage of and applying the paint and paint materials, and for all labor, equipment, tools, and incidentals necessary to complete the items.

## IV. SURFACE SEALING

This work shall consist of preparing and sealing concrete surfaces with epoxy penetrating sealer. The portions of the abutments and bents to be sealed shall include the vertical surface above the top of the abutment or bent and the top and the sides of the cap. The portion of the piers to be sealed shall include the top and sides to the bottom of the cap. On abutments, piers and bents that do not have a definite demarcation for a cap, the sealing shall extend twenty-four inches (24") below the top on all accessible sides.

## V. EXTENSION OF CAST IRON FLOOR DRAINS

## a) DESCRIPTION

Extend C.I. Floor Drains one foot with Poly Vinyl Chloride pipe using stainless steel bands to clamp in place.

## b) MATERIALS

P.V.C. Pipe with an I.D. of 6½ 1/8 inches and a length of 18" 1/2 inches with four 1/8 inch slots, 6 1/2 inches long in wall and parallel to the barrel of the pipe at one end. Stainless steel band having a width 3/4 inches and a thickness of 0.045 inches.

## c) SPECIFICATION

P.V.C. Pipe is to meet ASTM designations D-1784-68 Classification 1345A. Stainless steel band "Band-It" No. G430 or its equal. Band-It Company, 4799 Dahlia Street, Denver, Colorado, 80216.

d) PROCEDURE

Slip the slotted end of the P.V.C. Pipe over the Cast Iron Drain in place to the depth of the slots and band one inch from the top of the P.V.C. Pipe with 3/4 inch Stainless Steel band.

e) BASIS OF PAYMENT

This work will be paid for at the per each price bid for "Extension of C.I. Drains" in the structure, which payment shall be full compensation for furnishing, transporting, necessary storage of materials and for all labor, equipment, tools and incidentals necessary to complete the item.

IV. SPECIAL CLEANING AND PAINTING METHODS

- a) Where special areas exist on a bridge such as ornamental handrails, lattice work, inaccessible areas, or other such appurtenances, and when it becomes the opinion of the Engineer that these surfaces can not be cleaned to meet the requirements of this specification, he shall require the contractor to use other means, including hand chipping, scraping, grinding, etc. to remove all loose paint, scale and rust. These areas shall then be primed in accordance with Painting System #1, regardless of the system being used on other parts. No zinc coating shall be applied to areas where a commercial blast surface has not been attained.

In the special areas, the contractor may use, at his option, the finish coating of the Painting System specified for the structure.



- A. GENERAL: The contractor shall have the option of using either the Two Component or Single Package Zinc Silicate Paint.

Except as herein modified all surfaces to be painted shall receive one coat of Zinc Silicate Paint with a minimum dry film thickness of 2.5 mils and one coat of vinyl finish paint with a minimum dry film thickness of 3.0 mils. The dry film thickness of the coatings will be measured with a calibrated film thickness gage. The Engineer will be afforded every opportunity to check the film thickness of each coat of paint applied.

Before paint is applied it shall be thoroughly mixed so the pigment is completely in suspension and the consistency is uniform. It shall be kept in this condition while being applied. If Two Component Zinc Silicate Paint is selected, it shall, after initial mixing and before application, be strained through a metal screen not coarser than 30 mesh.

Thinning should not normally be required and will be permitted only under the conditions recommended by the manufacturer. If permitted, the thinner used will be that recommended by the manufacturer and the maximum quantity recommended will not be exceeded.

Paints shall be applied by either airless or conventional spray methods, except areas inaccessible to spray application may be painted by brush or daubers and small touch up areas may be painted by brush. Spray shall be adjusted to produce a uniformly applied coating.

Painting techniques will be such as to minimize dry over spray when using Zinc Silicate paints. Excessive dry over spray will be removed before application of the vinyl finish coat.

All areas where "mud cracking" occurs in a film of Zinc Silicate paint shall be scraped back to soundly bonded paint and recoated to the specified thickness.

The Zinc Silicate Paint shall be allowed to dry a sufficient length of time to permit the film to cure thoroughly throughout its entire thickness before applying the vinyl finish coat. This time will vary with weather conditions, but in no case will the drying time be less than that recommended by the manufacturer.

If the proper dry film thickness of the zinc silicate coat is not obtained with one coat, all surface contaminants, if present, shall be removed, and an additional coat applied. In no case shall the dry film thickness of the zinc silicate coat obtained in this manner exceed six (6) mils on flat surfaces.

Where surfaces have been painted with the full paint system but the paint coating has been damaged, the damaged areas will be scraped back to soundly bonded paint, and both the zinc silicate and vinyl coats re-applied.

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so that application of paint on steel is full and complete and spraying on the concrete is minimized.

Drainage castings shall be cleaned satisfactorily and painted with Black Field Paint. The castings shall not be shot blasted. If sand blasted, a brush-blast technique is to be used.

B. MATERIAL: The paint materials shall comply with the applicable provisions of 908.01 of the Standard Specifications and shall meet the following requirements:

1. TWO-COMPONENT ZINC SILICATE PAINT: This paint shall be a self-cure, two component, ethyl silicate type which, when mixed and applied in accordance with these specifications, cures without the use of a separate curing solution. It shall meet the following requirements:

- a. PIGMENT COMPONENT: The zinc portion of the pigment component shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other materials contained in the pigment component shall be inert.
- b. VEHICLE COMPONENT: The vehicle shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent blend and shall have the following properties:

Nonvolatiles % by wt., 3 hrs. @ 105°C.  $\pm$  5°C. 39--45

$\text{SiO}_2$ , % by wt. of vehicle, without pigment 9.0--12.0

Wt./gal. @ 77°F., lbs. 9.2--9.6

Storage life @ 77°F., months, minimum 12

c. MIXED PAINT PROPERTIES: When the two components are mixed in accordance with the manufacturer's instructions, the mixed paint shall meet the following requirements:

Wt./gal. @ 77°F., lbs. 17.0--19.0

Total solids, % by wt., minimum 72

Metallic Zinc in total solids, % by wt., minimum 75

Usable pot life @ 77°F., hrs., minimum 8

There shall be no hard caking or settling during this period which cannot be easily redispersed.

2. SINGLE PACKAGE ZINC SILICATE PAINT: The inorganic Zinc Silicate Paint shall be a single-package, self-curing type which, when mixed and applied in accordance with the manufacturer's current printed instructions, cures without the use of a separate curing solution.

- a. PIGMENT COMPONENT: The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other pigment constituents shall be chemically inert.
- b. VEHICLE COMPONENT: The vehicle shall consist primarily of a pre-hydrolyzed, acid catalyzed ethyl silicate in an appropriate solvent blend. The  $\text{SiO}_2$  content of the vehicle, without pigments, shall be 6-12 percent by weight.
- c. MIXED PAINT PROPERTIES: The mixed paint shall meet the following requirements:

Wt./gal. @ 77°F., lbs.	17.0--19.0
Total solids, % by wt., minimum (3 hrs. @ 105°C., $\pm$ 5°C.)	67.0
Metallic zinc in total solids, % by wt., minimum	75.0
Dry time, wet film from 6 mil blade clearance, on tin-coated steel panel @ 77°F., $\pm$ 2°F. and 60 %, $\pm$ 5 % relative humidity	30 min. to touch set, 24 hrs. to firm set

The paint shall have a usable storage life at 25°C., unopened, of at least six (6) months from the date of manufacture, during which period there shall be no hard caking or settling which cannot be easily dispersed by hand stirring, and there shall be no gelling or gassing.

- 3. PROPERTIES OF CURED COATING: Both the Two Component and Single Package Inorganic Zinc Silicate Paints shall be of such color as to produce a distinct contrast with a blast-cleaned metal surface and with the vinyl finish coat. In addition, the coating shall meet the following requirements when tested in accordance with Test Method Iowa 811:
  - a. FRESH WATER RESISTANCE: The coating shall show no blistering or softening, and there shall be no rusting in the scribed lines at the end of the test period.
  - b. SALT FOG RESISTANCE: After 1000 hours of exposure, the coating shall show no loss of bond, nor shall there be any rusting of the test panel or blistering of the coating beyond 1/16 inch from the center of the scribed lines.
  - c. TEMPERATURE & THERMAL SHOCK RESISTANCE: There shall be no evidence of blistering or flaking of the coating after treatment.
- 4. VINYL FINISH PAINT: The vinyl finish coating shall be a one-package, high build vinyl paint for use as a finish coat over a zinc silicate primer. It shall be compatible with and adhere to the cured zinc silicate coat.

- a. VEHICLE COMPONENT: The vehicle shall consist essentially of vinyl chloride - vinyl acetate copolymers. The copolymers may be modified with maleic anhydride and/or acrylic ester resins of high acrylate content. High molecular weight plasticizers of the phthalate or phosphate type shall be included in the vehicle in an amount not to exceed 15%, by weight, of the vehicle solids. The solvent system for the vehicle shall be such that all vehicle constituents are mutually soluble.
- b. PIGMENT COMPONENT: The pigment shall consist of titanium dioxide ( $TiO_2$ ) conforming to ASTM D476, Type IV; non-reactive, color retentive tinting pigments; and extenders and additives as needed for application properties, provided no impairment of other specified properties result.
- c. MIXED PAINT PROPERTIES: The mixed paint shall meet the following requirements:

Wt./gal. @ 77°F., lbs.	9.0--10.0
Viscosity @ 77°F., Krebs units	80--100
Total solids, % by wt., minimum (3 hrs. @ 105°C. $\pm$ 5°C)	48
Pigment grind, minimum, Hegman	5
Specular gloss, 60°	15--25
Dry time, 3 mil. wet film on tin coated steel panel, @ 77°F., $\pm$ 2°F. and 45-55% relative humidity	20 min. to touch set, 4 hrs. to firm set.
Hiding power, 6 mil. wet film on Moresst black and white chart paper	Complete dry film hiding

- d. COLOR: The color of the dried paint film shall match color #24227 of Federal Standard 595 (Latest edition in effect when advertised for bids).
  - e. STORAGE LIFE: The paint shall have a usable storage life of at least six (6) months from date of manufacture, during which period there shall be no hard caking or settling, no gelling or gassing, and it shall remain capable of easy dispersal by hand stirring.
  - f. APPLICATION: The paint shall be capable of application by brush, airless or conventional spray to the equivalent of 3 mils dry film without sags or runs.
- C. PACKAGING: Paint shall be delivered in new containers of such strength, durability, design, fabrication, and material that the paint will be suitably protected in transit and in storage against any change in characteristics which would cause rejection on the basis of laboratory or field evaluation.

Each container shall have a label clearly showing the name of the manufacturer, brand name of the paint, date of manufacture, net volume, and complete instructions and precautions for use.

If Two Component Zinc Paint is furnished, the two components shall be packaged in such proportions that the full quantity of pigment component mixed with the full quantity of the vehicle component will yield the specified mixed paint.

D. SAMPLING AND TESTING:

1. VINYL: Prior to use, the paint shall be tested and approved by the Division of Materials and Tests. A full, unopened container from each batch shall be submitted. The unused portion of the sample will be returned to the submitter. Sampling arrangements shall be such that at least ten (10) days is allowed to complete testing and approval after the sample is received at the Division's laboratory. Any rejected paint shall be removed from the job site before painting operations begin.
2. ZINC SILICATE: In addition to meeting the sampling and testing requirements for vinyl paint above, zinc silicate paints are subject to the following:
  - a. Prior to use of the paint, the manufacturer shall submit to the Division of Materials and Tests, a certified (notarized) test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements specified herein. In addition, the report shall state the manufacturer's name, brand name of paint, date of manufacture, the batch number tested, the dates of beginning and ending the resistance tests, and for two component paint, the exact weight ratio of zinc powder to the vehicle component used in the mixed paint tested.
  - b. New certified test reports in accordance with the above shall be submitted any time there is a change in formulation or manufacturing process, and may be required by the State when tests of material furnished indicate non-conformance to any of the specified requirements.

PAINTING STRUCTURAL STEEL

PA 001 PM

The paint and application of the paint for the structural steel in this contract shall be in accordance with the applicable provisions as follows;

I. GENERAL: Materials shall meet the requirements set out in the subsections noted.

13-F-11	Two Component Zinc Silicate Paint	V A of this provision
13 C/D 1051	Single Package Zinc Silicate Paint	V B of this provision
	Vinyl Finish Paint	V D of this provision
	White Field Paint	908.04(b) of the Standard Specifications
	Black Field Paint	908.04(c) of the Standard Specifications

The contractor shall have the option of using either the Two Component or Single Package Zinc Silicate Paint.

Except as herein modified all surfaces to be painted shall receive one coat of Zinc Silicate Paint with a minimum dry film thickness of 2.5 mils and one coat of vinyl finish paint with a minimum dry-film thickness of 3.0 mils. The dry-film thickness of the coatings will be measured with a calibrated film thickness gage. The Engineer will be afforded every opportunity to check the film thickness of each coat of paint applied.

II. CONSTRUCTION REQUIREMENTS: Surfaces to be painted shall be thoroughly cleaned in accordance with Article 619.03 of the Standard Specifications.

After the green finish coat is approved by the Engineer, the contractor shall stencil the following in two (2) inch black letters; PAINTED - contract number - date. This will be placed at eye level on the outside of a fascia beam.

Before paint is applied it shall be thoroughly mixed so the pigment is completely in suspension and the consistency is uniform. It shall be kept in this condition while being applied. If Two Component Zinc Silicate Paint is selected, it shall, after initial mixing and before application, be strained through a metal screen not coarser than 30 mesh.

Thinning should not normally be required and will be permitted only under the conditions recommended by the manufacturer. If permitted, the thinner used will be that recommended by the manufacturer and the maximum quantity recommended will not be exceeded.

No paint shall be applied to metal surfaces that are not entirely free from moisture or frost. Paint shall not be applied when the air temperature is below 40° F., when the air is misty, or when conditions are otherwise unsuitable. When painting in a protected area to eliminate the above conditions, the steel shall remain under cover until the paint is dry. Any wet paint exposed to excessive humidity, rain, snow, or condensation shall be permitted to dry, and damaged paint shall then be removed and the surface recleaned and repainted. Paint shall not be applied under any conditions of weather that in the opinion of the Engineer are unsatisfactory for painting.

Paints shall be applied by either airless or conventional spray methods, except areas inaccessible to spray application may be painted by brush or daubers and small touch up areas may be painted by brush. Spray shall be adjusted to produce a uniformly applied coating.

Painting techniques will be such as to minimize dry over-spray when using Zinc Silicate paints. Excessive dry over-spray will be removed before application of the vinyl finish coat.

All areas where "mud cracking" occurs in a film of Zinc Silicate paint shall be scraped back to soundly bonded paint and recoated to the specified thickness.

The Zinc Silicate Paint shall be allowed to dry a sufficient length of time to permit the film to cure thoroughly throughout its entire thickness before applying the vinyl finish coat. This time will vary with weather conditions, but in no case will the drying time be less than that recommended by the manufacturer.

If the proper dry-film thickness of the zinc silicate coat is not obtained with one coat, all surface contaminants, if present, shall be removed, and an additional coat applied. In no case shall the dry-film thickness of the zinc silicate coat obtained in this manner exceed 6 mils on flat surfaces.

III. SHOP PAINTING: Except as specified on the plans or as herein modified, all structural steel included in contracts which involve erection shall receive a zinc silicate coat, including contact surfaces of high-strength bolted connections and areas in contact with concrete.

Surfaces other than contact surfaces referred to above, which are inaccessible after erection, shall be painted in the shop with the full paint system required on the completed structure.

Machine finished surfaces for sliding contact shall be coated as soon as practicable after being accepted (before removal from the shop) with a hot mixture of 4 pounds of tallow, 2 pounds of white lead, and one quart of linseed oil, or with a heavy grease.

Erection marks shall be painted on previously painted surfaces. Shop-painted material shall not be loaded for shipment until the paint is dry.

IV. FIELD PAINTING: Unless otherwise specified, all structural steel that has received a zinc silicate coat, except contact surfaces or surfaces to be in contact with concrete, shall be painted after erection with the vinyl finish coat. When the Specifications do not permit the material to receive a zinc



silicate coat in the shop before incorporation into the structure, the surfaces which will be exposed shall be cleaned in accordance with Article 619.03 of the Standard Specifications before any paint is applied thereto and shall receive the zinc silicate coat after erection.

Before application of the vinyl finish coat, all areas where the zinc silicate coat was damaged during shipping, handling and erection, and all bolts and field connections shall be cleaned as specified in 619.03 and painted with zinc silicate paint to a condition equal to that required for the zinc silicate coat applied in the shop.

Where surfaces have been painted with the full paint system but the paint coating has been damaged, the damaged areas will be scraped back to soundly bonded paint, and both the zinc silicate and vinyl coats re-applied.

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so that application of paint on steel is full and complete and spraying on the concrete is minimized.

Drainage castings shall be cleaned satisfactorily and painted with Black Field Paint. The castings shall not be shot blasted. If sand blasted, a brush-blast technique is to be used.

If any painted surface is unsatisfactory to the Engineer, he may require removal of the paint, thorough cleaning of the surface, and repainting or other correction as directed.

All members inaccessible to field painting after being placed in final position shall have been given the vinyl finish coat before being erected.

After completion of the vinyl finish coat, the cover plates of end posts and the ends of plate girders at each end of the bridge shall be painted with eight (8) inch alternate stripes sloping down at an angle of  $45^{\circ}$  toward the side on which traffic will pass. The stripes will be White Codit Reflective

or equal and Black Field Paint. The striping shall extend from the floor level to the connection point of the cross-portal member, or the top of the chord, or to a point twelve (12) feet above the bridge floor, whichever is lowest.

If there is a steel railing, the roadway face shall be given one coat of White Field Paint.

The contractor shall protect pedestrian, vehicular, and other traffic on or underneath bridges and all portions of the bridge superstructure and substructure against damage or disfigurement from splatters, splashes, and smirches of paint or paint materials, sand, or shot.

Old steel bridges shall be cleaned and painted in accordance with the applicable requirements of this provision.

V. MATERIAL: The paint materials shall comply with the applicable provisions of 908.01 of the Standard Specifications and shall meet the following requirements:

(A.) Two-Component Zinc Silicate Paint: This paint shall be a self-cure, two-component, ethyl silicate type which, when mixed and applied in accordance with these specifications, cures without the use of a separate curing solution. It shall meet the following requirements:

1. PIGMENT COMPONENT: The zinc portion of the pigment component shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other materials contained in the pigment component shall be inert.
2. VEHICLE COMPONENT: The vehicle shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent blend and shall have the following properties:

Nonvolatiles % by wt., 3 hrs. @ 105°C. ± 5°C.	39--45
SiO <sub>2</sub> , % by wt. of vehicle, without pigment	9.0--12.0
Wt./gal. @ 77°F., lbs.	9.2--9.6
Storage life @ 77°F., months, minimum	12

3. MIXED PAINT PROPERTIES: When the two components are mixed in accordance with the manufacturer's instructions, the mixed paint shall meet the following requirements:

Wt./gal. @ 77°F., lbs.	17.0--19.0
Total solids, % by wt., minimum	72
Metallic Zinc in total solids, % by wt., minimum	75
Usable pot life @ 77°F., hrs., minimum	8

There shall be no hard caking or settling during this period which cannot be easily redispersed.

- (B) Single Package Zinc Silicate Paint: The inorganic Zinc Silicate Paint shall be a single-package, self-curing type which, when mixed and applied in accordance with the manufacturer's current printed instructions, cures without the use of a separate curing solution.

#### 1. COMPOSITION

(a) Pigment: The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other pigment constituents shall be chemically inert.

(b) Vehicle: The vehicle shall consist primarily of a pre-hydrolyzed, acid catalyzed ethyl silicate in an appropriate solvent blend. The SiO<sub>2</sub> content of the vehicle, without pigments, shall be 6-12 percent by weight.

(c) Mixed Paint: The mixed paint shall meet the following requirements:

Wt./gal @ 77°F., lbs.	17.0--19.0
Total solids, % by wt., minimum (3 hrs. @ 105°C., ± 5°C.)	67.0
Metallic zinc in total solids, % by wt., minimum	75.0
Dry time, wet film from 6 mil blade clearance, on tin-coated steel panel @ 77°F., ± 2°F. and 60 %, ± 5 % relative humidity	30 minutes to touch set, 24 hours to firm set

The paint shall have a usable storage life at 25°C., unopened, of at least six (6) months from the date of manufacture, during which period there shall be no hard caking or settling which cannot be easily dispersed by hand stirring, and there shall be no gelling or gassing.

C. PROPERTIES OF CURED COATING: Both the Two Component and Single Package Inorganic Zinc Silicate Paints must possess the following properties:

1. The cured coating shall be of such color as to produce a distinct contrast with a blast-cleaned metal surface and with the vinyl finish coat. In addition, the coating shall meet the following requirements when tested in accordance with Test Method Iowa 811:
  - (a) Fresh Water Resistance: The coating shall show no blistering or softening, and there shall be no rusting in the scribed lines at the end of the test period.
  - (b) Salt-Fog Resistance: After 1000 hours of exposure, the coating shall show no loss of bond, nor shall there be any rusting of the test panel or blistering of the coating beyond 1/16 inch from the center of the scribed lines.

(c) Resistance to Elevated Temperatures and Thermal Shock:

There shall be no evidence of blistering or flaking of the coating after treatment.

D. VINYL FINISH PAINT:

1. Description: The vinyl finish coating shall be a one-package, high build vinyl paint for use as a finish coat over a zinc silicate primer. It shall be compatible with and adhere to the cured zinc silicate coat.
2. Vehicle: The vehicle shall consist essentially of vinyl chloride - vinyl acetate copolymers. The copolymers may be modified with maleic anhydride and/or acrylic ester resins of high acrylate content. High molecular weight plasticizers of the phthalate or phosphate type shall be included in the vehicle in an amount not to exceed 15 %, by weight, of the vehicle solids. The solvent system for the vehicle shall be such that all vehicle constituents are mutually soluble.
3. Pigment: The pigment shall consist of titanium dioxide ( $TiO_2$ ) conforming to ASTM D476, Type IV; non-reactive, color retentive tinting pigments; and extenders and additives as needed for application properties, provided no impairment of other specified properties result.
4. Mixed Paint: The mixed paint shall meet the following requirements:

Wt/gal @ 77°F., lbs.	9.0--10.0
Viscosity @ 77°F., Krebs units	80--100
Total solids, % by wt., minimum (3 hrs. @ 105°C. $\pm$ 5°C)	48
Pigment grind, minimum, Hegman	5
Specular gloss, 60°	15--25
Dry time, 3 mil. wet film on tin coated steel panel, @ 77°F., $\pm$ 2°F. and 45-55% relative humidity	-20 minutes to touch set, 4 hours to firm set.
Hiding power, 6 mil. wet film on Moresst black and white chart paper	Complete dry film hiding

5. The color of the dried paint film shall match color #24227 of Federal Standard 595 (Latest edition in effect when advertised for bids)
6. The paint shall have a usable storage life of at least 6 months from date of manufacture, during which period there shall be no hard caking or settling, no gelling or gassing, and it shall remain capable of easy dispersal by hand stirring.
7. The paint shall be capable of application by brush, airless or conventional spray to the equivalent of 3 mils dry film without sags or runs.

VI. PACKAGING:

- A. Paint shall be delivered in new containers of such strength, durability, design, fabrication, and material that the paint will be suitably protected in transit and in storage against any change in characteristics which would cause rejection on the basis of laboratory or field evaluation.
- B. Each container shall have a label clearly showing the name of the manufacturer, brand name of the paint, date of manufacture, net volume, and complete instructions and precautions for use.
- C. If Two Component Zinc Paint is furnished, the two components shall be packaged in such proportions that the full quantity of pigment component mixed with the full quantity of the vehicle component will yield the specified mixed paint.

VII. SAMPLING AND TESTING:

- A. Vinyl: Prior to use, the paint shall be tested and approved by the Division of Materials and Tests. A full, unopened container from each batch shall be submitted. The unused portion of the sample will be returned to the submitter. Sampling arrangements shall be such that at

least 10 days is allowed to complete testing and approval after the sample is received at the Division's laboratory. Any rejected paint shall be removed from the job site before painting operations begin.

B. Zinc Silicate: In addition to meeting the sampling and testing requirements for vinyl paint above, zinc silicate paints are subject to the following:

1. Prior to use of the paint, the manufacturer shall submit to the Division of Materials and Tests, a certified (notarized) test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements specified herein. In addition, the report shall state the manufacturer's name, brand name of paint, date of manufacture, the batch number tested, the dates of beginning and ending the resistance tests, and for 2 component paint, the exact weight ratio of zinc powder to the vehicle component used in the mixed paint tested.

2. New certified test reports in accordance with the above shall be submitted any time there is a change in formulation or manufacturing process, and may be required by the State when tests of material furnished indicate non-conformance to any of the specified requirements.

TIME

BID DATE 12/20/78

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3000  
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2.00  
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The Contractor shall protect pedestrians, vehicular traffic and other traffic on the bridge or on the streets below, all portions of the bridge superstructure or substructure, and all adjacent property, against damage by paint spatter or splashes or cleaning abrasives. The Contractor shall be responsible for any damage caused by his operations to vehicles, property or persons.

- c. Surface Preparation: Before the application of any paint, all surfaces to be coated shall be cleaned and prepared in accordance with procedures described in the Structural Steel Painting Council (SSPC) Manual as specified herein and to the satisfaction of the Engineer. The surface preparation operation shall be periodically inspected by the Engineer. Any deviations from the specifications shall be corrected by the Contractor at no additional cost to the Commission.

The bridge suspender ropes shall be cleaned in accordance with SSPC-SP2, "Hand Tool Cleaning". All structural steel metalwork located below the approximate line of the bridge rail except the suspender ropes described above, shall be cleaned to a condition at least equal to Steel Structures Painting Council Specification SSPC-SP6, "Commercial Blast Cleaning." This includes all structural steel in the approach spans, all shoes, the lower chord of the truss spans and all floorbeams, diaphragms, stringers, and expansion device supports. All other structural steel above the approximate level of the bridge rail except the suspender ropes described above, shall be cleaned to a condition at least equal to Steel Structures Painting Council Specification SSPC-SP7, "Brush-Off Blast Cleaning". This includes structural steel in the truss upper chord, diagonals, posts, hangars, portals, sway frames and the upper lateral system.

- 1) Hand Cleaning: Hand cleaning of the bridge suspender ropes shall be done in accordance with SSPC-SP2. Oil, grease, soot or grime shall be removed by use of suitable solvents and/or detergents. Areas where rust spots appear shall be thoroughly cleaned by the use of wire brushes or scrapers. Sand blasting of suspender ropes will not be allowed.
- 2) Commercial Blast Cleaning: A commercial blast cleaned surface as defined in SSPC-SP6 is one on which all mill scale, rust, oil, grease, dirt and foreign material has been completely removed except for slight shadows, streaks or discolorations caused by rust stains, mill scale oxides, or slight tight residues of rust or paint in the bottom of pits. At least 2/3 of each square inch of surface area shall be limited to the discoloration, staining or residues as stated above.



3) Brush-Off Blast Cleaning: A brush-off blast cleaned surface, as defined in SSPC-SP7 is one from which all oil, grease, dirt, rust-scale, loose mill scale, loose rust and loose paint is removed completely, but tight mill scale and tightly-adhered rust and paint is permitted to remain provided that mill scale and rust has been exposed to the blasting operation sufficiently to expose numerous flecks of the underlying metal uniformly distributed over the entire surface.

4) Optional Water Blast: The Contractor may, at his option, clean the Cannelton Bridge suspender ropes by water blast using high-pressure water jet.

1. Painting. All structural steel shall be painted with one coat of either Type I or Type II prime coat and then a final vinyl top coat. All structural steel located below the approximate line of the bridge rail cleaned to a SSPC-SP6 finish shall receive a Type I prime coat, and the suspender ropes and all structural steel above the bridge rail cleaned to either a SSPC-SP2 or SSPC-SP7 finish shall receive a Type II prime coat.

The complete structure shall then receive the final vinyl top coat.

Except as herein modified, the prime coat shall have a minimum dry film thickness of 2.5 mils and the vinyl finish coat shall have a minimum dry film thickness of 3.0 mils. The dry film thickness of the coatings will be measured with a calibrated film thickness gage.

All paint shall be thoroughly mixed before application keeping the pigment in complete suspension and the paint consistency uniform, and shall be maintained in this condition while being applied.

Thinning should not normally be required and will be permitted only under the conditions recommended by the manufacturer. If permitted, the thinner used will be that recommended by the manufacturer and the maximum quantity recommended will not be exceeded.

Except for the bridge suspender ropes, paints shall be applied by either airless or conventional spray methods, except that those areas inaccessible to spray application may be painted by brush or daubers and small touch up areas may be painted by brush. Spray shall be adjusted to produce a uniformly applied coating. The bridge suspender ropes shall be painted by the brush method only.

Prime coat paint shall be allowed to dry a sufficient length of time to permit the film to cure thoroughly throughout its entire thickness before applying the vinyl finish coat. This time will vary with weather conditions, but in no case will the drying time be less than that recommended by the manufacturer.

Where surfaces have been painted with the full paint system but the paint coating has been damaged, the damaged areas will be scraped back to soundly bonded paint, and both the prime and vinyl finish coats re-applied. Concrete shall be adequately shielded or otherwise protected from overspray.

- e. **Type I Prime Coat:** The Contractor shall have the option of using either a two component or single package Inorganic Zinc Silicate Paint where the Type I prime coat is specified. The paint materials shall comply with the applicable provisions of 908.01 of the Standard Specifications and the following modification.

Painting techniques shall be such as to minimize dry overspray when using zinc silicate paint. Excessive dry overspray will be removed before application of the vinyl finish coat.

All areas where "mud cracking" occurs shall be scraped back to soundly bonded paint and relocated to the specified thickness.

If the proper dry film thickness of the zinc silicate coat is not obtained with one coat, all surface contaminants, if present, shall be removed, and an additional coat applied. In no case shall the dry film thickness of the zinc silicate coat obtained in this manner exceed 6.0 mils on flat surfaces.

- 1) **Two-Component Zinc Silicate Paint:** This paint shall be a self-curing two component, ethyl silicate type which, when mixed and applied in accordance with these specifications, cures without the use of a separate curing solution. It shall meet the following requirements.
  - (i) **Pigment Component:** The zinc portion of the pigment component shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other materials contained in the pigment component shall be inert.
  - (ii) **Vehicle Component:** The vehicle shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent blend and shall have the following properties:

Nonvolatiles % by wt. 3 hrs. @ 105°C. ± 5°C	39--45
S <sub>i</sub> O <sub>2</sub> , % by wt. of vehicle without pigment	9.0--12.0
Wt./gal @ 77°F., lbs	9.2--9.6
Storage life @ 77°F., months, minimum	12

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- (iii) Mixed Paint Properties: When the two components are mixed in accordance with the manufacturer's instructions, the mixed paint shall meet the following requirements:  
Wt./gal. @ 77°F., lbs. 17.0-19.0

Total Solids, % by wt., minimum 72

Metallic Zinc in total solids, % by wt, minimum 75

Usable pot life @ 77°F., hrs., minimum 8

There shall be no hard caking or settling during this period which cannot be easily redispersed.

- 2) Single Package Zinc Silicate Paint: The Inorganic Zinc Silicate Paint shall be a single-package, self-curing type which, when mixed and applied in accordance with the manufacturer's current printed instructions, cures without the use of a separate curing solution.

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- (i) Pigment Component: The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other pigment constituents shall be chemically inert.

- (ii) Vehicle Component: The vehicle shall consist primarily of a prehydrolyzed, acid catalyzed ethyl silicate in an appropriate solvent blend. The S<sub>i</sub>O<sub>2</sub> content of the vehicle, without pigments, shall be 6-12 percent by weight.

- (iii) Mixed Paint Properties: The mixed paint shall meet the following requirements:

Wt/gal. @ 77°F., lbs 17.0--19.0

Total solids, % by wt, minimum (3 hrs. @ 105°C., ±5°C.) 67.0

Metallic zinc in total solids, % by wt, minimum 75.0

Dry time, wet film from 6 mil blade clearance, on  
tin-coated steel panel @ 77°F., ±2°F. and  
60%, ±5% relative humidity

30 min. to  
touch set,  
24 hrs to  
firm set

The paint shall have a usable storage life at 25°C.,  
unopened, of at least six (6) months from the date of  
manufacture, during which period there shall be no hard  
caking or settling which cannot be easily dispersed by  
hand stirring, and there shall be no gelling or gassing.

3) Properties of Cured Coating: Both the Two Component and  
Single Package Inorganic Zinc Silicate Paints shall be of  
such color as to produce a distinct contrast with a  
blast-cleaned metal surface and with the vinyl finish  
coat. In addition, the coating shall meet the following  
requirements when tested in accordance with Test Method  
Iowa 811:

- (i) Fresh Water Resistance: The coating shall show no blistering  
or softening, and there shall be no rusting in the scribed  
lines at the end of the test period.
- (ii) Salt Fog Resistance: After 1000 hours of exposure, the  
coating shall show no loss of bond, nor shall there be  
any rusting of the test panel or blistering of the coating  
beyond 1/16 inch from the center of the scribed lines.
- (iii) Temperature & Thermal Shock Resistance: There shall be  
no evidence of blistering or flaking of the coating after  
treatment.

Type II Prime Coat: The Contractor shall apply to the structural  
steel designated for coverage with the Type II primer and to  
the suspender ropes one coat of an approved primer or tie coat  
of a composition compatible with and capable of being used  
with the existing paint system and the vinyl top coat. Such  
primer shall be applied in accordance with the manufacturer's  
current printed instructions, and shall be capable of curing  
without the use of a separate curing solution.

The primer is an alkyd type zinc chromate primer for use on  
ferrous metal surfaces. It shall have the following composition:

Pigment, % by wt.	45.5
Iron Oxide, Class II	2.3
Zinc-yellow	13.6
Mica	4.5
Silicates	25.1

Vehicle % by wt.	54.5
Linseed-Tung-Phenolic Alkyd Resin	19.2
Additives	.3
Aliphatic hydrocarbons	19.1
Alcohol	8.0
Glycol ethers	3.8
Ester	2.3
Aromatic hydrocarbons	1.6
Drier	.2

The paint shall have the following physical properties:

Weight per gallon, lbs	11.81 min. - 12.01 max.
Viscosity, K.U.	70 min. - 75 max.
Time of setting to touch	15 minutes
Time of recoat	2 hours

In areas where the brush-off blast cleaning operation exposed underlying metal, the Contractor shall apply a preliminary coating of the Type II primer over the exposed areas prior to the complete prime coat.

- g. Vinyl Finish Paint: The vinyl finish coating shall be a one-package, high build vinyl paint for use as a finish coat. It shall be compatible with and adhere to the cured Type I or Type II prime coat.

(i) Vehicle Component: The vehicle shall consist essentially of vinyl chloride - vinyl acetate copolymers. The copolymers may be modified with maleic anhydride and/or acrylic ester resins of high acrylate content. High molecular weight plasticizers of the phthalate or phosphate type shall be included in the vehicle in an amount not to exceed 15%, by weight, of the vehicle solid. The solvent system for the vehicle shall be such that all vehicle constituents are mutually soluble.

(ii) Pigment Component: The pigment shall consist of titanium dioxide ( $TiO_2$ ) conforming to ASTM D476, Type IV; non-reactive, color retentive tinting pigments; and extenders and additives as needed for application properties, provided no impairment or other specified properties result.

(iii) Mixed Paint Properties: The mixed paint shall meet the following requirements:

Wt./gal. @ 77°F., lbs 9.0--10.0

Viscosity @ 77°F., Krebs units 80.0--100

*G. 100*  
*Rever*  
*Mat*

Total Solids, % by wt., minimum (3 hrs. @ 105°C. 215°F) 48

Pigment grind, minimum, Hegman 5

Specular gloss, 60° 15--25

Dry time, 3 mil. wet film on tin coated steel panel, @ 77°F., ±2°F. and 45-55% relative humidity	20 min. to touch set, 4 hrs to firm set
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Hiding power, 6 mil. wet film on Moresst black and white chart paper	Complete dry film hiding
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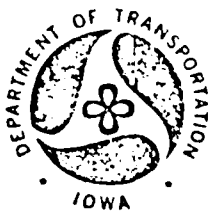
(iv) Color: The color of the dried paint film shall be green matching color #24227 of Federal Standard 595 (Latest edition in effect when advertised for bids).

(v) Storage Life: The paint shall have a usable storage life of at least six (6) months from date of manufacture, during which period there shall be no hard caking or settling, no gelling or gassing and it shall remain capable of easy dispersal by hand stirring.

(vi) Application: The paint shall be capable of application by brush airless or conventional spray to the equivalent of 3 mils dry film without sags or runs.

h. Sampling and Testing: The Contractor, prior to the start of work, shall submit manufacturer's certification that the paint proposed for use meets all the requirements specified herein and in the Standard Specifications. This certified (notarized) test report shall be from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements and compatibility requirements specified herein. The report shall state the manufacturer's name, brand name, date of manufacture, batch number tested, the dates of beginning and ending the resistance tests, and for two component paint, the exact weight ratio of zinc powder to the vehicle component used in the mixed paint tested.

New certified test reports in accordance with the above shall be submitted any time there is a change in formulation or manufacturing process.



# Department of Transportation

## HIGHWAY DIVISION

800 LINCOLN WAY AMES, IOWA 50010 515-296-1101

*Send to  
John O. Leary  
WV*

REF. NO. 435.19

Paint Specifications

January 16, 1979

14 OCT 1979

Mr. James A. Roberson  
Mobil Chemical Co.  
27815 108th Ave. North  
Port Byron, IL 61275

Dear Jim:

Enclosed are specification revisions for paint that will be used in 1979. Also enclosed is a copy of the standard paint specifications to which these revisions apply. These changes are the same as you saw during your recent visit.

The samples of the vinyl paints which Paul Devine submitted will serve as the official approval samples. The vinyl enamel will be listed as product number 580-G-801 and the high-build as 583-G-806. As previously discussed, stocks of old high-build vinyl which you or a contractor may have on hand, can be supplied until depleted.

We will be issuing a new list of approved products as soon as possible. In the meantime, you can consider your paints all approved for 1979.

Yours very truly,

Max I. Sheeler  
Chemical Tests Engineer

MIS:go

Enc.

H - 112

COMMISSIONERS

LEWIS, JOHN R.    BARBARA, J.    DONALD, J.    WILLIAM, J.    JAMES, J.    JAMES, J.    JAMES, J.    JAMES, J.    JAMES, J.    JAMES, J.

## SPECIFICATION REVISIONS FOR PAINT

Add the following new article to Section 4180:

4180.00 VINYL RESINS. The vinyl resins shall be vinyl chloride-acetate copolymers produced by a solution polymerization process and shall have film-forming properties. The vinyl resins shall meet the following composition requirements for the type designated:

- A. Vinyl Resin Type 1. The resin shall contain 85 to 88% vinyl chloride and 12 to 15% vinyl acetate, by weight.
- B. Vinyl Resin Type 2. The resin shall contain 1% interpolymerized dibasic acid, 81.5 to 87% vinyl chloride, and 12 to 17.7% vinyl acetate, by weight.
- C. Vinyl Resin Type 3. The resin shall contain 5.3% to 6.5% hydroxyl, 89.5 to 91.5% vinyl chloride, and 2.0 to 5.3% vinyl acetate, by weight.

Delete the second paragraph in 4182.01 and add the following in lieu thereof:

The pigments and vehicles specified for vinyl finish coatings and the foliage green paint shall be as described in Sections 4180 and 4181 where applicable.

Delete all of 4182.03 and substitute the following in lieu thereof:

4182.03 VINYL FINISH COATINGS. These specifications cover one package vinyl paints of the high-build and enamel types for use as finish coats on bridges.

The high-build vinyl paint shall be formulated to display compatibility with and adhesion to a cured coating of the zinc silicate paint specified in 4182.02. The color shall match Iowa standard foliage green, or shall be white, as may be required. It is intended for use as a finish coat over zinc silicate paint or as an intermediate coat between zinc silicate primer and a vinyl enamel finish coat.

The vinyl enamel shall be formulated to display compatibility with and adhesion to a cured coating of high-build vinyl paint described herein. The color shall match Iowa standard foliage green. It is intended for use over high-build vinyl and not for use over zinc silicate primer.

The paints shall meet the following requirements:

- A. Vehicle. The vehicle for each paint shall primarily consist of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. The vehicles



shall be plasticized with a pure chemical plasticizer of the phthalate or phosphate type and shall be stabilized with an epoxy resin stabilizer. The vehicle solids shall have the following composition with a tolerance for each ingredient of plus or minus one (1) percent:

	<u>Hi-Build</u>	<u>Enamel</u>
Vinyl Resin, Type 1, percent	19.0	48.0
Vinyl Resin, Type 2, percent	48.7	16.0
Vinyl Resin, Type 3, percent	-	15.0
Plasticizer, percent	22.9	11.4
Epoxy Resin Stabilizer, percent	9.4	8.8

- B. Pigment Composition. The pigment portion of the individual paints shall meet the following requirements:

	<u>Fol.Green Hi-Build</u>	<u>White Hi-Build</u>	<u>Fol.Green Enamel</u>
Total chrome oxide green and rutile titanium dioxide, % minimum	29.0	-	67.0
Rutile titanium dioxide, % minimum	-	54.0	-

The remainder shall be tinting and extender pigments except the vinyl enamel shall not contain extender pigments.

- C. Mixed Paint. The finished paints shall meet the following requirements:

	<u>Hi-Build</u>	<u>Enamel</u>
Pounds per gallon at 77 degrees F., minimum	9.7	9.0
Percent pigment by weight, minimum	29.0	16.0
Percent vehicle solids by weight, minimum	19.0	19.0
Specular Gloss, 60 degrees, minimum	-	30
Dry time, set to touch, minutes, minimum	20	20

humus and a high degree of fertility. Surface soils from ditch bottoms, drained ponds, and eroded areas, or soils which are supporting growth of noxious weeds or other undesirable vegetation will not be accepted. Topsoil shall not be excessively acid or excessively alkaline (pH value 6.0 to 7.5). It shall be free from hard clods, rocks, and other debris larger than 2 inches in diameter.

*B. Peat* shall consist of partially decomposed stems and leaves of hypnum, polytrichum, and other mosses free from woody substances and weed seeds. It shall show a pH value of 5.0 to 7.0. Peat shall have a maximum ash content of 30 percent.

*C. Fertilizer* shall consist of 12-12-12 or equivalent chemically combined fertilizer.

*D. Staking and Guying.* Stakes for plant material shall be either yard lumber of 2 by 2 inches nominal dimension, permitting small knots that do not impair serviceability, or steel posts meeting requirements of 4154.09. The stakes shall be of the length specified in 2602.08.

Guys used shall be a good commercial quality of galvanized No. 9 wire or 3/16-inch cable.

Pieces of new fabric-reinforced garden hose or an approved equal shall be used to protect the plants from damage by guys. Anchors used shall be constructed of steel of the sizes specified in 2602.08 as approved by the engineer.

*L. Mulch* shall be as specified on the plans or in special provisions.

*F. Tree Wrap.* Wrapping shall be a crinkle-type, kraft, tree wrap paper 4 inches wide, or a tree wrap approved by the engineer.

#### Section 4180. Paint Vehicles

*4180.01 GENERAL.* Unless otherwise specified, the raw materials for paint vehicles shall meet requirements of the following specifications for the respective material.

*4180.02 RAW LINSEED OIL.* ASTM D 231 shall apply.

*4180.03 LIQUID DRIER, CLASS B NAPHTHATE.* ASTM D 600, Class B, shall apply.

*4180.04 MINERAL SPIRITS.* ASTM D 235 shall apply.

*4180.05 ALKYD VARNISH NO. 2.* This alkyd resin solution shall meet requirements of FSS TT-R-266, Type I, Class A.

## Section 4181. Paint Pigments

**4181.01 GENERAL.** Unless otherwise specified, the individual pigments for paints shall meet requirements of the following specifications for the respective material.

Lampblack  
 Chrome oxide green  
 Basic lead silico-chromate  
 Titanium dioxide

ASTM D 209  
 ASTM D 263  
 ASTM D 1648  
 ASTM D 476

## Section 4182. Paints

**4182.01 GENERAL.** Paints shall be well ground, shall not cake, gel, skin, or badly settle in the container, and shall be readily redispersed with a paddle to a smooth, uniform product of proper consistency which allows drying without running, streaking, or sagging when applied to a smooth, clean, vertical, steel surface. Suitable paint additives shall be used to promote good package stability and to control the working characteristics of the paint to provide a satisfactory product. When specified, the paint shall match the color sample which will be furnished by the engineer.

The foliage green paint shall be composed of pigments and vehicles described in Sections 4180 and 4181.

**4182.02 ZINC-SILICATE PAINT.** This paint shall be either a two component or catalyzed, single-component, self-cure ethyl silicate zinc-rich paint which cures without use of a separate curing solution. It is intended for use only on blast-cleaned steel and for spray application. Limited application by brush can be made. The paint shall meet the following requirements:

**A. Pigment.** The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other materials contained in the pigment or pigment component shall be inert.

**B. Vehicle.** The vehicle component of the two component type shall have a storage life at 77 degrees F of not less than 12 months.

**C. Mixed Paint Properties.** The single-package paint or the two component paint mixed in accordance with the manufacturer's instructions, shall meet the following requirements:

Weight per gallon at 77 degrees F, not less than 16.8 pounds.

Percent total solids, by weight

Single component, not less than 67.0.

Two component, not less than 72.0.

Percent metallic zinc, by weight, of total solids, not less than

75.0.

The two-component type shall have a usable pot life of not less

than 8 hours at 77 degrees F. The single-component type shall

have a storage life of not less than 6 months.

There shall be no settling of the pigment which cannot be easily

dispersed during either the pot- or storage-life periods.

*D. Properties of Cured Coating.* The cured coating shall be of such color as to produce a distinct contrast with a blast-cleaned metal surface. In addition, the cured coating shall meet the following requirements when tested in accordance with Laboratory Test Method 811.

Fresh water resistance. The coating shall show no blistering or softening, and there shall be no rusting in the scribed lines, at the end of the 30-day test period.

Salt-fog resistance. After 500 hours of exposure, the coating shall show no loss of bond, nor shall there be any rusting of the test panel or blistering of the coating beyond 1/16 inch from the center of the scribed lines.

Resistance to elevated temperature and thermal shock. There shall be no evidence of blistering or flaking of the coating after treatment.

**4182.03 VINYL FINISH COATING.** This paint shall be a one package, high-build, vinyl paint so formulated to display compatibility with and adhesion to a cured coating of the zinc silicate paint specified in 4182.02. The color shall match the Iowa standard foliage green, or shall be white, whichever is required by the contract. It is intended for use only as a finish coat over zinc silicate paint and primarily for spray application. It shall be made by the same manufacturer that makes the zinc-silicate paint over which it is applied. The paint shall meet the following requirements:

*A. Vehicle.* The vehicle shall consist essentially of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure adequate tensile strength of the paint film.

*B. Mixed Paint.* The paint shall air dry entirely from evaporation of the solvents and shall meet the following requirements:

Weight per gallon, pounds, at 77 degrees F.	9.0-11.0
Percent total solids, by weight, minimum	48
Percent vehicle solids, by weight, minimum	19
Drying time	
Set to touch - not more than 20 minutes	
Dry through - not more than 4 hours	

**4182.04 PRIMER FOR METAL.** This paint shall meet requirements of AASHTO M 229, Type II (FSS TT-P-615, Type II). It is intended as a primer over ferrous metal surfaces and may be applied by spray, brush, or roller.

**4182.05 INTERMEDIATE COAT FOR METAL.** This paint shall meet requirements of 4182.04, except that five pounds of red iron oxide per 100 gallons of paint shall be replaced with lampblack to provide color contrast. It is intended as a second coat over the primer specified in 4182.04.

**4182.06 FOLIAGE GREEN PAINT.** This paint is intended as a finish coating over the intermediate coating specified in 4182.05. It shall match the Iowa standard foliage green color and meet the following requirements:

**Composition and Characteristics**

Pigment - not less than 40.0 percent  
Vehicle - not more than 60.0 percent  
Weight per gallon at 77 degrees F. - not less than 11.1 lbs.  
Consistency at 77 degrees F., Krebs Units - 68-75  
Grind, North Standard - not less than 5  
Drying time:  
Set to touch - not more than 4 hours  
Dry through - not more than 18 hours.

**Pigment Composition**

Basic lead silico chromate - not less than 44.0 percent  
Total chrome oxide green and rutile titanium dioxide - not less than 52.0 percent  
Tinting colors (phthalocyanine green or blue, no iron allowed) - not more than 4.0 percent.

**Vehicle Composition**

Alkyd varnish No. 2 - not less than 67.0 percent  
Raw linseed oil - not less than 4.6 percent  
Mineral spirits, driers, and paint additives - not more than 28.4 percent.

**4182.07 WHITE SEMIGLOSS ENAMEL.** This paint shall be a silicone alkyd semigloss enamel meeting requirements of FSS TT-E-490. Colors other than white may be used, when specified. It is intended as an intermediate and finish coating over the primer specified in 4182.04.

**4182.08 ALUMINUM PAINT.** This paint shall meet requirements of AASHTO M 69, Type I. It is intended as a finish coat over the intermediate coating specified in 4182.05 or as the initial coat on treated lumber.

**4182.09 GENERAL PURPOSE WHITE PAINT.** This paint shall meet requirements of AASHTO M 70, Type I, Class C. It is intended for use on wood structures and for other general purposes as an exterior finish coat.

**4182.10 WASH PRIMER PRETREATMENT.** This paint shall meet requirements of Military Specification MIL-P-15328 (Formula 117). It is intended for use on aluminum or galvanized surfaces prior to application of a coating system. It may also be used on blast-cleaned steel when specified.

**4182.11 PACKAGING.** All containers shall be new metal pails, free of physical defects, and of such type as to prevent attack by the paint or paint components. Each container shall bear a label clearly showing the name of manufacturer, brand name, lot number, date of manufacture, net weight of contents, and complete instructions and precautions for use.

The two component zinc silicate paint shall be in such amounts that the quantity of pigment component mixed with the quantity of vehicle component will yield the specified mixed paint. Instructions and precautions for the two component zinc silicate paint need only to appear on the vehicle component container.

**418212 BASIS OF ACCEPTANCE.** Inspection and acceptance of zinc silicate paint and the vinyl finish coating shall be in accordance with Instructional Memorandum 418209. All other paints shall be sampled and tested on a lot basis for acceptance.

### Section 4183. Traffic Paints

**418301 GENERAL.** These specifications cover two grades of white and yellow traffic paint for use in marking traffic lanes on bituminous and concrete highways.

The color of the yellow paint shall visually match color No. 33538 of Federal Standard No. 595. The U.S. Bureau of Public Roads, Highway Yellow Color Tolerance Chart, June 1965, shall be used to determine color tolerance limits.

**418302 SLOW-DRY TRAFFIC PAINT.** The paint shall meet the following composition and physical characteristic requirements.

**A. Vehicles.** The vehicles shall meet the following requirements for the type specified.

#### Alkyd Resin Solution

Type	Pure drying medium oil
Type of Oil	Soya, linseed, or both
Type of Solvent	VM&P naphtha
Nonvolatile Matter	49 to 51%
Phthalic Anhydride*	3.3% min
Acid Value*	4 to 10
Oil Acids*	50% min
Viscosity, Gardner-Holdt	7 to 22
Color, Gardner-Holdt	8 Max
Resin or Resin Derivatives	None
*Nonvolatile basis	

Naphtha: Requirements of FSS T1 S-95, Type 1

Liquid Driers: Requirements of ASTM D600, Class B

**B. Pigments.** The pigments shall meet the following ASTM or stated requirements.

Titanium Dioxide: #1476, Type III  
 Manganese Chromic Yellow: #1211, Type III  
 Aluminum Silicate, Hydrous: D605, with an oil absorbency of 35 to 45 by ASTM D281  
 Silica: Amorphous, 99.5% silicon dioxide and an oil absorption of 29 to 41 by ASTM D281  
 Pigment Suspending Agent: The agent shall be an organic ammonium compound of montmorillonite.

**C. Composition Requirements.** All percentages are by weight.

Pigment (White and Yellow) 49.0 to 51.0%

Pigment Composition	White	Yellow
Titanium Dioxide	24.0%	26.0%
Manganese Chromic Yellow	—	11.0%
Aluminum Silicate	26.0%	11.0%
Silica	50.0%	60.0%
Suspending Agent (see below)*		

#### Vehicle Composition

Alkyd Resin Solution	74.0%	75.0%
Naphtha, Driers, and Antiskinning Agent	26.0%	25%

\*Pigment Suspending Agent: A suitable amount of agent prewetted with methanol or ethanol, shall be added to achieve desired storage stability requirements.



ROUGH DRAFT

IOWA DEPARTMENT OF TRANSPORTATION  
Ames, Iowa

SPECIAL PROVISIONS  
for

REPAINTING BRIDGES  
(Environmental Protection)

March 27, 1979

THE STANDARD SPECIFICATIONS, SERIES OF 1977, ARE AMENDED BY THE FOLLOWING ADDITIONS. THESE ARE SPECIAL PROVISIONS AND SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

.01 GENERAL. The contractor shall make a reasonable effort to contain old paint chips, corrosion residues, and spent abrasives, herein referred to as waste materials, resulting from blasting and other cleaning operations. Caution shall be exercised to avoid depositing or dropping waste materials into water, and onto the ground or roadways below the structure.

Blasting or other cleaning operations shall not be performed when the direction or velocity of prevailing winds prevents reasonable containment of waste materials or that, in the opinion of the engineer, causes a pollution problem.

Specific control measures shall be designated in the contract proposal as "Regular Containment" or "Special Containment."

A. Regular Containment shall consist of the following:

1. Ground and roadway coverage. The contractor shall provide cover on or over the ground, highways, and railways under the structure in the work area, capable of catching and holding waste materials. The length of the cover shall be determined by the length of the work area and the width shall be at least 5 feet greater than each side of the area directly under the steel to be cleaned. Edges of the cover shall be turned upward to minimize loss of waste materials. Covers on or over roadways shall not present a hazard of any kind and shall not remain in place overnight.
2. Waterway coverage. The contractor shall provide a cover that laps and continues from the ground cover provided and extends upward over the water at an angle of about 45 degrees. The cover shall be capable of holding and deflecting the waste materials towards the waterway-bank and shall be at least 12 feet in length and at least 5 feet wider than each side of the area directly under the steel to be cleaned. The cover shall be anchored at the waterway-bank with the end over the water suspended from the structure. If an obstruction is encountered, such as a pier in the water near the shoreline, the cover shall extend from the bank to the obstruction. Outside edges of the cover shall be turned upward to minimize loss of waste materials. The cover shall not remain in place overnight if it presents a hazard of any kind.
3. Floating waste materials. The scum that forms on the water from waste materials that do not sink in place, shall be contained from moving upstream or downstream by use of straw dams or floating boom devices. If the scum tends to collect at the containing device, it shall be contained, collected and not allowed to travel beyond the device. The straw used for damming shall be replaced with clean straw weekly or as needed.
4. Disposal of waste materials. The contained waste materials that remain on the bridge deck, on the ground covers and on the waterway covers shall be removed at least once a day or more frequently, if required. No waste materials shall remain on the bridge deck or containment covers overnight. Waste materials shall not be removed through floor drains or by throwing them over the side of the bridge. The contained waste materials and used straw from dam devices shall be disposed of at a legal disposal site.

B. Special Containment shall consist of the same measures required for regular containment, except for waterway coverage, where the contractor shall provide cover over the waterways in the work area capable of catching and holding waste materials. The cover shall meet the requirements specified for regular containment over ground and roadways.

When the bridge location and characteristics or the surrounding topography do not lend themselves to the specified control measures, modifications may be approved by the engineer or specific control measures may be specified in the special provisions.



ROUGH DRAFT

IOWA DEPARTMENT OF TRANSPORTATION  
Ames, Iowa

Supplemental Specifications  
for

PAINTING STEEL BRIDGE STRUCTURES

March 27, 1979

THE STANDARD SPECIFICATIONS, SERIES OF 1977, ARE AMENDED BY THE FOLLOWING MODIFICATIONS, ADDITIONS, AND DELETIONS. THESE ARE SUPPLEMENTAL SPECIFICATIONS, AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

ADD the following new paragraph to 2508.03:

Blast cleaning on an outdoor job site located in urban areas or other sensitive areas may be restricted to use of white silica sand. This shall be designated in the special provisions.

DELETE all of 2508.04 and add the following in lieu thereof:

2508.04 PAINT SYSTEMS. Except as herein modified, all surfaces to be painted shall receive one prime coat of zinc silicate paint with an average dry-film thickness of at least 3.0 mils and one coat of high-build vinyl finish coating of sufficient thickness to hide the prime coat and make the total average dry-film thickness of the two coats at least 6.0 mils. The minimum dry-film thickness of the prime coat measured at any point shall be 2.5 mils and the minimum total dry-film thickness of the two-coat system measured at any point shall be 5.0 mils. The color of the high-build, vinyl finish coating shall be foliage green, except as modified below.

For highway structures with ungalvanized steel rail elements above the floor and no structural steel elements above the floor, the entire rail and post elements shall receive the prime coat and a high-build, white vinyl finish coat. Steel posts and rails on structures designed to carry railway traffic shall receive the prime coat and a high-build, foliage green vinyl finish coat. On structures where the rail post is bolted to the top of the concrete curb, the joint between the steel base plate and the concrete shall be sealed with a 3/8- to 5/8-inch bead of white, elastomeric caulking compound.

All surfaces of structural steel elements above the floor or that extend above the floor, outside surfaces of exterior beams or girders, the bottom surface of the lower flange on exterior beams or girders, all surfaces on exterior elements of deck trusses, all surfaces of exterior bearing elements, and surfaces on exterior drain pipe, that are painted with foliage green, high-build, vinyl finish coating, shall receive one coat of foliage green, vinyl enamel. The dry-film thickness of the enamel coat shall be sufficient to hide the high-build vinyl coating and make the total average dry-film thickness of the three-coat system at least 7.0 mils and the minimum total dry-film thickness measured at any point at least 6.0 mils.

The dry-film thickness of the coatings will be measured with a calibrated, magnetic, film-thickness gage. The engineer shall be afforded every opportunity to check the film-thickness after each coat of paint is applied.

ADD the following to the first paragraph of 2508.05:

For new structures, the prime coat shall be applied in the fabrication shop.

DELETE all of Article 2508.06 and add the following in lieu thereof:

2508.06 FIELD PAINTING. Unless otherwise specified, all structural steel that has received a prime coat, except contact surfaces, shall be painted after erection with the specified vinyl finish coats. When the specifications do not permit the steel to receive a prime coat in the shop before incorporation into the structure, the surfaces which will be exposed shall be cleaned and shall receive the prime coat after erection.

Before application of vinyl finish coats, all areas where the prime coat has been damaged during shipping, handling, and erection, areas that develop corrosion products before or after erection, and exposed surfaces of all rivets and other connectors installed in the field shall be cleaned as specified in 2508.03 and painted with zinc-silicate primer to a condition equal to that required for the prime coat applied in the shop.

Where surfaces have been painted with the full paint system before erection and the coatings are damaged so the prime coat is severely affected or where primer failure occurs on areas adjacent to vinyl-coated surfaces, the affected areas shall be cleaned, primed with an approved organic-soluble, zinc-rich paint, and painted with the specified vinyl finish coats, before erection if applicable.



Old structures, to be repainted shall be cleaned and painted with the full paint system as specified herein. When continuous I-beam or welded girder structures are being repainted, the cracks formed between splice plates, fill plates, webs and flanges on the outside surfaces of exterior beams shall be sealed with a small bead of compatible, elastomeric caulking compound after a primer has been applied and before application of vinyl paint. The extent of painting to be performed may be stipulated in the proposal or special provisions for the project.

On completion of all painting, the word "painted" followed by the month and year shall be permanently stenciled on an inconspicuous surface in a manner and location approved by the engineer.

DELETE all of Article 2508.11 and add the following in lieu thereof:

2508.11 TRAFFIC PROTECTION AND POLLUTION CONTROL. The contractor shall use every reasonable means to protect the environment, persons, adjacent property, and vehicles from damage because of his operations, in accordance with 1107.07, 1107.08, and 1107.09. When repainting old structures traffic control and pollution control measures shall be as follows:

A. Traffic Control When the contract is for painting only, the road shall be kept open to traffic, and no work will be permitted on Sundays, holidays, or the day immediately preceding or following a holiday. The contractor may restrict traffic to one lane but not more than half the roadbed, if necessary, from 1/2 hour after sunrise to 1/2 hour before sunset, but shall permit traffic to pass safely at all times, except for occasional, unavoidable interruptions.

The contractor shall provide two flagmen or traffic control signals to direct traffic at any time he restricts traffic from a traffic lane or when traffic is delayed by unavoidable interruptions.

The contractor shall place and maintain traffic warning signs each way from the work. The signs only will be furnished by the contracting authority, free of charge to the contractor at the maintenance garage for that area, but they shall be placed and removed, as necessary, by the contractor, and returned when work is completed, in accordance with 1107.09. The contractor shall notify the local foreman two days in advance of the date the signs will be needed.

Any equipment or supplies that obstruct the roadbed during the day shall be removed as far from the traveled way as is practical from 1/2 hour before sunset to 1/2 hour after sunrise, and the roadbed shall be open full width to permit normal traffic.

B. Pollution Control. Specific pollution control and environmental protection procedures may be required by the special provisions.

ADD the following new Article to Section 4180:

4180.06 VINYL RESINS. The vinyl resins shall be vinyl chloride-acetate copolymers produced by a solution polymerization process and shall have film-forming properties. The vinyl resins shall meet the following composition requirements for the type designated:

Vinyl Resin Type 1. The resin shall contain 85 to 88% vinyl chloride and 12 to 15% vinyl acetate, by weight.

Vinyl Resin Type 2. The resin shall contain 1% interpolymerized dibasic acid, 81.5 to 87% vinyl chloride, and 12 to 17.7% vinyl acetate, by weight.

Vinyl Resin Type 3. The resin shall contain 5.3% to 6.5% hydroxyl, 89.5 to 91.5% vinyl chloride, and 2.0 to 5.3% vinyl acetate, by weight.

DELETE the second paragraph in 4182.01 and add the following in lieu thereof:

The pigments and vehicles specified for vinyl finish coatings and the foliage green paint shall meet applicable requirements of 4180 and 4181.

DELETE all of Article 4182.03 and substitute the following in lieu thereof:

4182.03 VINYL FINISH COATINGS. These specifications cover one-package, vinyl paints of the high-build and enamel types for use as finish coats on bridges.

The high-build vinyl paint shall be formulated to display compatibility with and adhesion to a cured coating of the zinc silicate paint specified in 4182.02. The color shall match Iowa standard foliage green, or shall be white, as may be required. It is for use as a finish coat over zinc silicate paint or as an intermediate coat between zinc silicate primer and a vinyl enamel finish coat.

The vinyl enamel shall be formulated to display compatibility with and adhesion to a cured coating of high-build vinyl paint described herein. The color shall match Iowa standard foliage green. It is for use over high-build vinyl and not for use over zinc silicate primer.

The paints shall meet the following requirements:

A. Vehicle. The vehicle for each paint shall primarily consist of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. The vehicles shall be plasticized with a pure chemical plasticizer of the phthalate or phosphate type and shall be stabilized with an epoxy resin stabilizer. The vehicle solids shall have the following composition with a tolerance for each ingredient of plus or minus one percent:

	<u>Hi-Build</u>	<u>Enamel</u>
Vinyl Resin, Type 1, percent	19.0	48.0
Vinyl Resin, Type 2, percent	48.7	16.0
Vinyl Resin, Type 3, percent	-	15.0
Plasticizer, percent	22.9	11.4
Epoxy Resin Stabilizer, percent	9.4	8.8

B. Pigment Composition. The pigment portion of the individual paints shall meet the following requirements:

	<u>Fol. Green Hi-Build</u>	<u>White Hi-Build</u>	<u>Fol. Green Enamel</u>
Total chrome oxide green and rutile titanium dioxide, % minimum	29.0	-	67.0
Rutile titanium dioxide, % minimum	-	54.0	-

The remainder shall be tinting and extender pigments except the vinyl enamel shall not contain extender pigments.

C. Mixed Paint. The finished paints shall meet the following requirements:

	<u>Hi-Build</u>	<u>Enamel</u>
Pounds per gallon at 77 Degrees F, minimum	9.7	9.0
Percent pigment by weight, minimum	29.0	16.0
Percent vehicle solids by weight, minimum	19.0	19.0
Specular Gloss, 60 degrees, minimum	-	30
Dry time, set to touch, minutes, minimum	20	20

IOWA STATE HIGHWAY COMMISSION

Materials Department

METHODS OF TEST FOR ZINC SILICATE PAINT

Scope

These methods of test cover the procedures for determining the corrosion and thermal resistance properties of self-cure zinc silicate paint.

Apparatus

- A. Salt spray fog chamber (ASTM B117).
- B. Steel test panels, 0.024 inch minimum thickness, 10 square inches minimum surface area.
- C. Muffle furnace, capable of heating to 500°F.

Procedures

- A. Preparation of Test Panels. Blast clean the surface of three (3) steel test panels to white metal using abrasives that produce a nominal height of profile of 1.5 mils. Spray coat the cleaned surface with not less than a 3 nor more than a 4 mil dry film thickness of self-cure zinc silicate paint. Allow the paint to cure for 48 hours at 60 to 85°F. and 45 to 55 percent relative humidity before testing.

- B. Thermal Shock Resistance. Heat a coated test panel in the muffle furnace at 500°F. for one hour, then quench immediately in 60 to 70°F. water. Examine the coating for blistering or flaking.
- C. Fresh Water Resistance. Scribe the coating on a test panel down to base metal with an X made with at least 2 inch lines. Completely immerse the test panel in fresh tap water at 70 to 80°F. for 30 days. At the end of the test period examine the coating for blistering or softening and examine the scribed lines for rusting of the steel.
- D. Salt Fog Resistance. Scribe the coating on a test panel down to base metal with an X made with with at least 2 inch lines. Test the panel in accordance with ASTM B117. After 1000 hours of continuous exposure, examine the coating for loss of bond and blistering and the scribed lines for the extent of rusting of the steel.

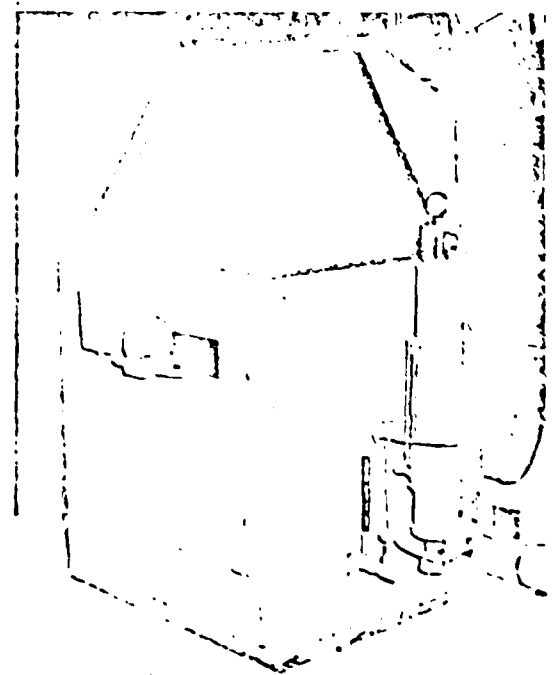


Fig. 1  
Salt Spray Fog Chamber

IOWA STATE HIGHWAY COMMISSION  
Ames, Iowa

SUPPLEMENTAL SPECIFICATION  
for  
PAINTING STEEL STRUCTURES  
(Zinc Silicate - Vinyl System)

March 19, 1974

THE STANDARD SPECIFICATIONS, SERIES OF 1972, ARE AMENDED BY THE FOLLOWING ADDITIONS. FOR WORK TO WHICH THIS SPECIFICATION APPLIES, SECTION 2508 IS SUPERSEDED, AND THE PAINT REQUIREMENTS MAY BE CONSIDERED AS A NEW ARTICLE 4182.09. THESE ARE SUPPLEMENTAL SPECIFICATIONS AND SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

748.01 SCOPE. This specification covers painting of steel structures using a self-cure zinc silicate primer and includes the paint and painting requirements. The painting of steel structures with the zinc silicate-vinyl system shall include preparation of surfaces to be painted, application, protection, and drying of paint coatings, protection of all parts of the structure from paint spatter and disfigurement, final cleanup, and supplying of all equipment, labor, materials, and traffic control necessary for the work.

748.02 MATERIALS. The paint materials shall meet the following requirements:

A. Zinc Silicate Paint. The zinc silicate paint shall be a self-cure, two-component, ethyl silicate vehicle type, zinc silicate paint which, when mixed and applied in accordance with these specifications, cures without use of a separate curing solution. It shall meet the following requirements:

1. Pigment Component. The zinc portion of the pigment component shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc and a minimum of 98 percent total zinc. The zinc powder shall have a specific gravity of 7.00 to 7.15, and the average particle size shall not exceed 9.5 microns as determined by the Fisher Sub-sizer. All other materials contained in the pigment component shall be inert.
2. Vehicle Component. The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate alcohol solvent and shall have the following properties:

Nonvolatile at 105 degrees C., percent by weight,	29.43
Silicon Dioxide, percent by weight of vehicle (without pigments),	9.0 - 12.0
Weight per gallon, pounds, at 77 degrees F.,	9.2 - 9.6
Storage life at 77 degrees F., months, minimum,	12

3. Mixed Paint Properties. When the two components are mixed in accordance with the manufacturer's instructions, the mixed paint shall meet the following requirements:

Weight per gallon at 77 degrees F., pounds,	17.0 - 19.0
Percent total solids, by weight, not less than,	72
Total solids shall be composed of not less than 75 percent zinc.	
The paint shall not gel when contaminated with up to one percent water by volume.	
The usable pot life shall be not less than 8 hours at 77 degrees F., and there shall be no hard setting during this period which cannot be easily redispersed.	

4. Properties of Cure Coatings. The cured coating shall be of such color as to produce a distinct contrast with a blast-cleaned metal surface and with the vinyl finish coat. In addition, the cured coating shall meet the following requirements when tested in accordance with Test Method No. Iowa 811:

Fresh water resistance. The coating shall show no blistering or softening, and there shall be no rusting in the scribed lines, at the end of the test period.

Salt-foe resistance. After 1000 hours of exposure, the coating shall show no loss of bond, nor shall there be any rusting of the test panel or blistering of the coating beyond 1/16 inch from the center of the scribed lines.

Resistance to elevated temperature and thermal shock. There shall be no evidence of blistering or flaking of the coating after treatment.

B. Vinyl Finish Coating. The vinyl finish coating shall be manufactured by the supplier of the self-cure zinc silicate paint. It shall be a one-package, high-build vinyl paint so formulated to display compatibility with and adhesion to the cured zinc silicate primer coat. It shall be well ground and shall not be caked, gelled, skinned, or badly settled in the container. The color may be aluminum or white or shall match the color sample of foliage green furnished by the engineer, whichever is specified in the contract.

1. Vehicle. The vehicle shall consist essentially of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure adequate tensile strength of the paint film.
2. Mixed Paint. The paint shall air dry entirely from evaporation of the solvent and shall meet the following requirements:

Weight per gallon, pounds, at 77 degrees F.,	9.0 - 11.0
Percent pigment, minimum,	20
Percent vehicle solids, minimum,	19

specified under surface preparation and painted with zinc silicate paint to a condition equal to that required for the prime coat applied in the shop.

Where surfaces have been painted with the full paint system but the paint coating has been damaged, the damaged areas shall be cleaned, primed with an approved organic-vehicle zinc-rich paint, and painted with vinyl finish coat before erection.

Old structures, to be repainted, shall be cleaned and painted with the full paint system as specified herein. The extent of the painting to be performed will be stipulated in the proposal or special provisions for the project.

**748.07 PAINTING CONDITIONS.** No paint shall be applied to metal surfaces that are not entirely free from moisture or frost. Zinc silicate paint shall not be applied when the atmosphere surrounding the metal is at a temperature below 25 degrees F., and vinyl paint shall not be applied when the atmosphere surrounding the metal is at a temperature below 35 degrees F. When painting in a protected area to eliminate the above conditions, the steel shall remain under cover until the paint is dry. Any wet paint exposed to excessive humidity, rain, snow or condensation shall be permitted to dry, and damaged paint shall then be removed and the surface recleaned and repainted. Paint shall not be applied under any conditions of weather that in the opinion of the engineer are unsatisfactory for painting.

**748.08 MIXING PAINT.** Before paint is applied, it shall be thoroughly mixed so the pigment is completely in suspension and the consistency is uniform. It shall be kept in this uniform condition while being applied. Zinc silicate paint, after initial mixing, shall be strained through a metal screen not coarser than 30 mesh nor finer than 60 mesh before application.

Thinning will be permitted when required for proper application. The type of thinner used and the amount used shall be as recommended by the paint manufacturer.

**748.09 APPLICATION.** Paints shall be applied by either airless or conventional spray methods, except areas inaccessible to spray application may be painted by brush or daubers and small touch-up areas may be painted by brush. Spray shall be adjusted to produce a uniformly applied coating. The paint shall be thinned for spraying to suit the prevailing wind and temperature conditions so that a wet spray is provided at all times and the deposition of semi-dry particles on the surface is avoided.

All areas where "mud cracking" occurs in a film of zinc silicate paint shall be scraped back to soundly bonded paint and recoated as specified under shop painting to the same thickness specified for the original coat.

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so that application of paint on steel is full and complete without spraying on the concrete.

**748.10 DRYING.** The zinc silicate paint shall be allowed to stand a sufficient length of time to permit the film to cure thoroughly throughout its entire thickness before applying the vinyl finish coat. This time will vary with weather conditions, but in no case should the drying time be less than that recommended by the manufacturer. The primer shall be thoroughly cured before the metal is loaded for shipment.

**748.11 TRAFFIC PROTECTION AND RESPONSIBILITY.** When repainting old structures, traffic protection shall be as follows:

The contractor shall use every reasonable means to protect persons and vehicles from injury or damage that might occur because of his operations in accord with 1107.06 and 1107.09, and when the contract is for painting only, the road shall be kept open to traffic.

The contractor may restrict traffic to one lane but not less than half the roadbed, if necessary, from 1/2 hour after sunrise to 1/2 hour before sunset, but shall permit traffic to pass safely at all times, except for occasional unavoidable interruptions.

The contractor shall provide two flagmen or traffic control signals to direct traffic at any time he restricts traffic from a traffic lane, and/or when traffic is delayed by unavoidable interruptions.

The contractor shall place and maintain traffic warning signs each way from the work. The signs only will be furnished by the Iowa State Highway Commission, free of charge to the contractor, but they shall be placed and removed as necessary by the contractor. The contractor shall notify the local Highway Commission Foreman two days in advance of the date the signs will be needed.

Any equipment or supplies that obstruct the roadbed during the day shall be removed as far from the traveled way as is practical from 1/2 hour before sunset to 1/2 hour after sunrise, and the roadbed shall be open full width to permit normal traffic.

**748.12 BASIS OF PAYMENT.** The painting of new structures will not be paid for separately, but will be considered as incidental to the fabrication and erection of structural steel, the cost to be included in the contract price for the steel.

Contracts for painting old structures will be paid for by a lump sum for cleaning and painting an individual structure. The contract price shall be full payment for furnishing all equipment, labor, materials, and traffic control necessary to complete the work in accordance with the specifications.

2. Mixed Paint. The paint shall air dry entirely from evaporation of the solvent and shall meet the following requirements:

Weight per gallon, pounds, at 77 degrees F.,	11.0
Percent pigment, minimum,	20
Percent vehicle solids, minimum	10
Drying time:	
Set to touch - not more than 20 minutes	
Dry through - not more than 4 hours	

C. Packaging. All containers shall be new metal pails, free of physical defects, and of such type as to prevent attack by the paint or paint components. The zinc silicate paint shall be packaged in two-compartment containers or in two separate containers. The two components shall be packaged in such proportions that the quantity of pigment component mixed with the quantity of vehicle component will yield the specified mixed paint. Each container shall bear a label clearly showing the name of manufacturer, brand name of paint, lot number, date of manufacture, net weight of contents, and complete instructions and precautions for their use. The instructions and precautions for zinc silicate paint need only to appear on the vehicle component container.

D. Basis of Acceptance. Inspection and acceptance of these paints shall be in accordance with Materials Department instruction memorandum No. 482.09.

748.03 SURFACE PREPARATION. All steel surfaces to be painted shall be blast cleaned with suitable abrasives producing a surface with a nominal height of profile of 1.5 mils. At least 95 percent of each square inch of blast-cleaned surface shall be free of all visible residues down to bare metal, and the remain of the area shall be limited to very light discolorations caused by rust stain or mill scale oxides, or slight, tight residues of paint. Excessive stratified rust or rust scale may be removed by suitable hand or power-impact tools prior to blast cleaning.

Before painting, all blast products shall be removed from the surfaces, and the cleaning shall be approved by the engineer. The blast-cleaned surfaces shall be given the prime coat of zinc silicate paint within 24 hours after cleaning, unless otherwise authorized by the engineer. The surfaces shall be primed before rust forms.

Where touch-up of a prime coat is required, cleaning of small areas may be with wire brush or power tools. Larger areas shall be blast cleaned.

The prime coat shall be cleaned of all dirt, oil, oxidation products, and other detrimental foreign matter by bristle brushes, high pressure water, or washing with petroleum solvents, and the surfaces allowed to dry, before applying the vinyl finish coat.

748.04 PAINT SYSTEMS. Except as herein modified all surfaces to be painted shall receive one prime coat of zinc silicate paint with a minimum dry-film thickness of 2.5 mils and one coat of vinyl finish coating with a minimum dry-film thickness of 3.0 mils. The color of the vinyl finish coating shall be either aluminum or foliage green, as specified in the contract, except as modified below.

On highway structures where ungalvanized steel rail parts are mounted on the edges of concrete slabs or mounted on curbs or pass through such curbs, the entire area of the steel rails and posts, above the bottom of the floors, shall receive the prime coat and a white vinyl finish coat. Steel posts and rails or structures designed to carry railway traffic shall be painted with the full system using either aluminum or foliage green vinyl finish coat.

The dry-film thickness of the coatings will be measured with a calibrated mikrotest film thickness gage. The engineer shall be afforded every opportunity to check the film thickness of each coat of paint applied.

748.05 SHOP PAINTING. Except as specified on the plans or as herein modified, all structural steel included in contracts which involve erection shall receive the prime coat, including contact surfaces of high-strength bolted connections and areas in contact with concrete. The dry-film thickness of the prime coat shall be 1.0 to 1.5 mils for contact surfaces of high-strength bolted connections and tops of beams and girders, in lieu of the thickness specified for the regular paint system.

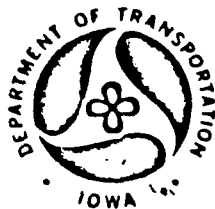
Surfaces other than the contact surfaces referred to above, which are accessible before erection, shall be painted in the shop with the full paint system required on the completed structure.

Machined surfaces with small clearances between moving components, such as full-circle pins and pin holes, partial-circle pins and pin recesses in castings, and similar surfaces, shall not be painted. Machined surfaces on bottoms of rockers and machined surfaces of plates upon which rockers will be in rolling contact shall be painted.

If the proper dry-film thickness of the primer coat is not obtained with one coat, all contaminants, if present, shall be removed, and an additional coat of primer applied using zinc silicate paint that has been thinned up to 2 quarts per gallon. The amount of thinning will depend on the desired film build, but in no case shall the total dry-film thickness of the primer coat, obtained in this manner, exceed 6.0 mils.

748.06 FIELD PAINTING. Unless otherwise specified, all structural steel that has received a prime coat, except contact surfaces or surfaces to be in contact with concrete, shall be painted after erection with the vinyl finish coat. When the specifications do not permit the material to receive a prime coat in the shop before incorporation into the structure, the surfaces which will be exposed shall be cleaned and shall receive the prime coat after erection.

Before application of the vinyl finish coat, all areas where the prime coat was damaged during shipping, handling, and erection, and all field rivets and field connections shall be cleaned at



# Department of Transportation

## HIGHWAY DIVISION

800 LINCOLN WAY AMES, IOWA 50010 515-296-1101

REF NO

September 27, 1979

Mr. Fred Ordway  
Executive Vice President  
Artecht Corp.  
2901 Telestar Court  
Falls Church, Virginia 22042

4 OCT 1 P.M.

Dear Mr. Ordway:

Deputy Director, George Calvert asked me to respond to your September 19 letter about paint.

Iowa's standard paint system uses an inorganic zinc-rich paint as a prime or shop coat. It is described in 4182.02. This is covered by a high-build vinyl finish coat described in 4182.03. On areas exposed to the sunlight, an additional coat of vinyl enamel is applied; this is also described in 4182.03.

In developing this standard, both organic and inorganic systems were tried. Our experience was that the organic paint was easier to apply, but the inorganic paint gave better service.

Our satisfaction is not just from the paint system. Cleaning is to a near-white condition (SSPC-SP10 using SSPC-Visl pictorial reference). The thickness is specified as dry-film thickness and it is closely checked. A special training school was held for paint inspectors when the standard was changed from the previous lead paint system. This system is used for new bridges and repainting existing bridges.

Zinc-rich paint is also used to touch up small, damaged areas on galvanized surfaces in other highway construction. We have no specifications for this. Most of it is a commercial product with a single-component, organic vehicle.

Sincerely,

T. E. McElherne, Director  
Office of Specifications and  
Emergency Planning

TEM:bac  
cc: George Calvert  
Attach: 2508 and 4182 with Spec. 852 modification

### COMMISSIONERS

H - 128

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Red Oak

constructed in lifts, nrap can be dumped directly in place from the surface of each lift.

~~2507.04 METHOD OF MEASUREMENT. The quantity of Class A, B, or C revetment will be computed by the engineer in square yards from measurements of the surface as constructed. Class D (Ritrap) revetment will be measured in tons. Only material placed in accordance with the plans and specifications will be measured.~~

~~2507.05 BASIS OF PAYMENT. For the quantity of revetment constructed, the contractor will be paid the contract price per square yard or ton, which price shall be full payment for furnishing and placing all material, including a filter course, if specified, and for performing all labor, including excavation and backfilling, necessary to complete the work according to the plans and these specifications.~~

#### Section 2508. Painting Steel Bridge Structures

**2508.01 GENERAL.** This work consists of painting or repainting structural steel on bridges using a self-cure zinc-silicate primer and vinyl finish. The work includes preparation of surfaces to be painted; application, protection, and drying of paint coatings; protection of all parts of the structure from paint spatter and disfigurement; final cleanup; and supplying of all equipment, labor, materials, and traffic control necessary for the work.

**2508.02 MATERIALS.** All materials for painting structural steel shall meet requirements of Section 4182.

**2508.03 SURFACE PREPARATION.** All steel surfaces to be painted shall be blast cleaned to a near-white condition in accordance with Steel Structures Painting Council Specifications SSPC-SP10. The pictorial reference standards contained in SSPC-Vis 1 which correspond to Specification SSPC-SP10 will be used to aid the evaluation of the surface cleaning. The nominal height of profile shall be 1.0 to 2.5 mils. When shot is used for blasting, it must contain sufficient grit to produce a sharp, angular anchor pattern.

Before painting, all blast products shall be removed from the surfaces, and the cleaning shall be approved by the engineer. The blast-cleaned surfaces shall be given the prime coat of zinc silicate paint within 21 hours after cleaning, unless otherwise authorized by the engineer. The surfaces shall be primed before rust forms.

Where touch-up of a prime coat is required, cleaning of small areas may be with wire brush or power tools. Larger areas shall be blast cleaned.

The prime coat shall be cleaned of all dirt, oil, oxidation products, and other detrimental foreign matter by bristle brushes,

high-pressure water, or washing with petroleum solvents, and the surfaces allowed to dry, before applying the vinyl finish coat.

**2508.04 PAINT SYSTEMS.** Except as herein provided, all surfaces to be painted shall receive one prime coat of zinc silicate paint with an average dry film thickness of at least 3.0 mils, and one coat of vinyl finish coating with an average dry-film thickness of at least 3.0 mils. The minimum dry-film thickness measured at any point for each coating shall be 2.5 mils. The color of the vinyl finish coating shall be foliage green, except as modified below.

For highway structures with only ungalvanized steel rail elements above the floor and no structural steel elements above the floor, the entire rail and post elements shall receive the prime coat and a white vinyl finish coat. Steel post, and rails on structures designed to carry rail-way traffic shall be painted with the full system using the foliage green vinyl finish coat specified for the remainder of the bridge. On structures where the rail post is welded to the top of the concrete curb, the joint between the steel base plate and the concrete shall be sealed with a 3/8- to 5/8-inch bead of white, elastomeric caulking compound.

The dry-film thickness of the coatings will be measured with a calibrated, mikrotak, film-thickness gage. The engineer shall be afforded every opportunity to check the film thickness of each coat of paint applied.

**2508.05 SHOP PAINTING.** Except as specified on the plans or as herein modified, all structural steel included in contracts which involve erection shall receive the prime coat, including contact surfaces of high-strength bolted connections. Surfaces against which plastic concrete is to be placed shall not be painted. The dry-film thickness of the prime coat shall be at least 1.0 mil for contact surfaces of high-strength bolted connections in lieu of the thickness specified for the regular paint system.

Surfaces which are not to be in contact, which are accessible before erection but which will be inaccessible after erection, shall be painted in the shop with the full paint system required on the completed structure.

Machined surfaces with small clearances between moving components, such as full-circle pins and pin holes, partial-circle pins and pin recesses in castings, and similar surfaces, shall not be painted. For new structures, these surfaces shall be coated with grease in the shop and field according to 2508.03. Machined surfaces on bottoms of rockers and machined surfaces of plates upon which rockers will be in rolling contact shall be painted.

If the proper dry-film thickness of the prime coat is not obtained with one coat, all contaminants, if present, shall be removed, and an additional coat of primer applied using zinc silicate paint that has been thinned up to 2 quarts per gallon. The amount of thinning will depend on the desired film build, but in

Add. Sec.

Revised

Revised and Addition



# PAINTING STRUCTURES

2508.06

no case shall the total dry-film thickness of the primer coat, obtained in this manner, exceed 6.0 mils.

**2508.06 FIELD PAINTING.** Unless otherwise specified, all structural steel that has received a prime coat, except contact surfaces, shall be painted after erection with the vinyl finish coat. When the specifications do not permit the material to receive a prime coat in the shop before incorporation into the structure, the surfaces which will be exposed shall be cleaned and shall receive the prime coat after erection.

Before application of the vinyl finish coat, all areas where the prime coat has been damaged during shipping, handling, and erection, and all field rivets and field connections, shall be cleaned as specified under surface preparation and painted with zinc silicate paint to a condition equal to that required for the prime coat applied in the shop.

Where surfaces have been painted with the full paint system but the paint coating has been damaged, the damaged areas shall be cleaned, primed with an approved organic-vehicle, zinc-rich paint, and painted with vinyl finish coat before erection.

Old structures, to be repainted, shall be cleaned and painted with the full paint system as specified herein. The extent of painting to be performed may be stipulated in the proposal or special provisions for the project.

**2508.07 WEATHER CONDITIONS.** No paint shall be applied to metal surfaces that are not entirely free from moisture or frost. Paint shall not be applied when the atmosphere surrounding the metal is at a temperature below 35 degrees Fahrenheit. When painting in a protected area to eliminate the above conditions, the steel shall remain under cover until the paint is dry. Any wet paint exposed to excessive humidity, rain, snow, or condensation shall be permitted to dry, and damaged paint shall then be removed and the surface cleaned and repainted. Paint shall not be applied under any conditions of weather that, in the opinion of the engineer, are unsatisfactory for painting.

**2508.08 MIXING PAINT.** Before paint is applied, it shall be thoroughly mixed so the pigment is completely in suspension and the consistency is uniform. It shall be kept in this uniform condition while being applied. Zinc silicate paint, after initial mixing, shall be strained through a metal screen not coarser than 30 mesh nor finer than 60 mesh, before application.

Thinning will be permitted when required for proper application. The type of thinner used and the amount used shall be as recommended by the paint manufacturer.

**2508.09 APPLICATION.** Paints shall be applied by either airless or conventional spray methods, except areas inaccessible to spray; application may be painted by brush or dusters, and small touch-up areas may be painted by brush. Application of paint

2508.10

# PAINTING STRUCTURES

shall produce a smooth, uniform coating. The paint shall be thinned for spraying to suit prevailing weather conditions so that a wet spray is provided at all times and the deposition of particles which are dry when they strike the surface is avoided. In this regard, care shall be used to insure that the spray nozzle is held close enough to the surface to avoid excessive loss of volatile.

All areas where "mud cracking" occurs in a film of zinc silicate paint shall be scraped back to soundly bonded paint and recoated as specified under shop painting to the same thickness specified for the original coat.

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so that application of paint on steel is full and complete without spraying on the concrete.

**2508.10 DRYING.** The zinc silicate paint shall be allowed to stand a sufficient length of time to permit the film to cure thoroughly throughout its entire thickness before applying the vinyl finish coat. This time will vary with weather conditions, but in no case should the drying time be less than that recommended by the manufacturer. The primer shall be thoroughly cured before the metal is loaded for shipment.

**2508.11 TRAFFIC PROTECTION AND RESPONSIBILITY.** When repainting old structures, traffic protection shall be as follows:

The contractor shall use every reasonable means to protect persons and vehicles from injury or damage that might occur because of his operations, in accord with 1107.08 and 1107.09. When the contract is for painting only, the road shall be kept open to traffic, and no work will be permitted on Sundays, holidays, or the day immediately preceding or following a holiday. The contractor may restrict traffic to one lane but not less than half the roadbed, if necessary, from 1/2 hour after sunrise to 1/2 hour before sunset, but shall permit traffic to pass safely at all times, except for occasional, unavoidable interruptions.

The contractor shall provide two flagmen or traffic control signals to direct traffic at any time he restricts traffic from a traffic lane, and/or when traffic is delayed by unavoidable interruptions.

The contractor shall place and maintain traffic warning signs each way from the work. The signs only will be furnished by the contracting authority, free of charge to the contractor at the maintenance garage for that area, but they shall be placed and removed, as necessary, by the contractor, and returned when the work is completed, in accordance with 1107.09. The contractor shall notify the local Foreman two days in advance of the date the signs will be needed.

Any equipment or supplies that obstruct the roadbed during the day shall be removed as far from the traveled way as is

# PAINTING STRUCTURES

2508.12

practical from 1/2 hour before sunset to 1/2 hour after sunrise, and the roadbed shall be open full width to permit normal traffic.

**2508.12 BASIS OF PAYMENT.** The painting of new structures will not be paid for separately, but will be considered as incidental to the fabrication and erection of structural steel, the cost to be included in the contract price for the steel.

Contracts for painting old structures will be paid for by a lump sum for cleaning and painting an individual structure. The contract price shall be full payment for furnishing all equipment, labor, materials, and traffic control necessary to complete the work in accordance with the specifications.

## Section 2509. Miscellaneous Painting

**2509.01 DESCRIPTION.** This work shall consist of painting metal or wood surfaces on new or existing installations except for structural steel on bridges. The work includes preparation of surfaces to be painted, application, protection, and drying of paint coatings, protection of all parts of the installation from paint spatter and disfigurement, final cleanup, and supplying of all equipment, labor, materials, and traffic control necessary for the work.

**2509.02 WEATHER CONDITIONS.** Paint shall be applied only to thoroughly dry surfaces and when the atmosphere surrounding the surfaces is at a temperature at or above 40 degrees F. Materials painted in a protected area during adverse weather conditions shall remain under cover until the paint is dry. Any wet paint exposed to excessive humidity, rain, snow, or condensation shall be permitted to dry and damaged paint shall be removed and the surface re-cleaned and repainted. Paint shall not be applied under any conditions of weather that, in the opinion of the engineer, are unsatisfactory for painting.

**2509.03 MIXING PAINT.** Before paint is applied, it shall be thoroughly mixed so the pigment is completely in suspension and the consistency is uniform. It shall be kept at this uniform consistency while being applied. No thinning of paint will be permitted unless otherwise specified.

**2509.04 APPLICATION.** Unless otherwise specified, paints shall be applied by brush, spray, or roller. Regardless of method used, the paint shall be smoothly and uniformly spread so that the surface is completely coated without an excess of paint collecting at any point. All runs, sags, or curtains shall be brushed out immediately.

Brushes, when used, shall not be wider than 4 inches. When spray methods are used, adequate shielding or protection shall be

2509.07

## MISCELLANEOUS PAINTING

provided, so that application of paint on the surfaces being painted is complete without spraying on adjoining surfaces not to be painted.

Surfaces inaccessible for painting by regular means shall be painted with sheepskin daubers or other methods approved by the engineer.

**2509.05 DRYING.** Each coat of paint shall be allowed to stand a sufficient length of time to permit the film to dry thoroughly throughout its entire thickness before the next coat is applied. During the drying period, the painted surfaces shall be protected from excessive dust, blast-cleaning products, or other deleterious materials.

**2509.06 TRAFFIC PROTECTION AND RESPONSIBILITY.** When repainting existing installations, traffic protection shall be in accordance with 2508.11.

**2509.07 PAINTING GALVANIZED STEEL.** Unless otherwise specified, ungalvanized steel surfaces to be painted, other than structural steel on bridges, shall be cleaned and painted in accordance with provisions of 2509.01 to 2509.05, inclusive, and this article.

**A. Surface Preparation.** The steel surfaces to be painted shall be cleaned to bare metal by commercial blast cleaning in accordance with Steel Structures Painting Council Specification SSPC-SP6. The pictorial reference standards contained in SSPC-Vol. 1, which correspond to SSPC-SP6, will be used to aid in evaluation of surface cleaning.

Before painting, all blast products shall be removed from the surfaces, and the cleaning shall be approved by the engineer. The blast-cleaned surfaces shall be given the prime coat within 24 hours after cleaning, unless otherwise authorized by the engineer. The surfaces shall be primed by the rust forms. Before subsequent coats of paint are applied, the previously painted surface shall be cleaned of any foreign matter by bristle brush or washing with solvents, and the surface allowed to dry.

**B. Paint Systems.** All surfaces to be painted shall receive three coats of paint according to one of the following paint systems, whichever is specified in the contract.

- System I
  - First Coat - Primer for Steel, 4182.04
  - Second Coat - Intermediate Coat for Steel, 4182.05
  - Third Coat - Finish Green Paint, 4182.06
- System II
  - First Coat - Primer for Steel, 4182.04
  - Second Coat - Intermediate Coat for Steel, 4182.05
  - Third Coat - Aluminum Paint, 4182.03
- System III
  - First Coat - Primer for Steel, 4182.04
  - Second Coat - White Semi-gloss Enamel, 4182.07
  - Third Coat - White Semi-gloss Enamel, 4182.07

The paint used for the second coat in System III shall be limited to provide a slight contrast with the third coat.

# PLANT MATERIALS

4170.04

**4170.04 INSPECTION OF PLANT MATERIAL.** Inspection of plant material may be made at the nursery or collecting field by an authorized representative of the contracting authority. Approval of material on such examination shall not be construed as final acceptance of the material. Final acceptance will not be made until the material has been delivered and installed.

**4170.05 SAMPLES.** The engineer may require samples to be submitted before stock is shipped from the nursery to the planting site.

**4170.06 GOVERNMENT INSPECTION.** All plant material shall comply with State and Federal laws, with respect to inspection for plant disease and infestation. Any inspection certificates required by law to this effect shall accompany each shipment, invoice, or order of stock. On arrival the certificate shall be filed with the engineer.

All contractors shall comply with rules and regulations of the State Entomologist of Iowa, relative to nursery inspection of nursery stock in accordance with provisions of Section 177A.5, Iowa Crop Pest Act, Chapter 177A, Code of Iowa.

**4170.07 PREPARATION OF PLANTS FOR SHIPMENT.** All trees shall come directly from the nursery row, except container-grown material, and shall be dug with reasonable care and shall immediately prior to shipment. For spring planting, the only plant material that will be accepted from cold storage, will be shrub and ground-cover types. Precautions shall be taken to avoid any unnecessary injury or removal of fibrous roots. All precautions customary in good trade practice shall be taken to insure arrival of the plants at destination in good condition for successful growth. Barked and burlapped plants shall be lifted from the nursery row with a firm ball so as to retain as many fibrous roots as possible.

**4170.08 SHIPMENT OF PLANTS.** All material shall be packed in such manner as to insure adequate protection against climatic, seasonal, or other injuries during transit. Bare-root trees and shrubs shall be placed in bundles, and roots shall be carefully protected with wet straw, moss, or other suitable material which will insure arrival of plants at destination with roots in a moist, healthy condition. All evergreens and bare-root material shall be protected during transport by use of an enclosed vehicle or by covering with a tarp.

**4170.09 INCIDENTAL MATERIALS FOR PLANT INSTALLATION.** Materials of the following types to be furnished for the proper installation of plant materials shall meet the requirements:

A. Topsoil shall be high-quality soil consisting of the top 6 inches of field or pasture loam containing a good supply of

4180.05

# PAINT VEHICLES

humus and a high degree of fertility. Surface soils from ditches, bottom, drained ponds, and eroded areas, or soils which are supporting growth of noxious weeds or other undesirable vegetation, will not be accepted. Topsoil shall not be excessively acid or excessively alkaline (pH value 6.0 to 7.5). It shall be free from hard clods, rocks, and other debris larger than 2 inches in diameter.

B. Peat shall consist of partially decomposed stems and leaves of hyppnum, polypodium, and other mosses free from woody substances and weed seeds. It shall show a pH value of 5.0 to 7.0. Peat shall have a maximum ash content of 20 percent.

C. Fertilizer shall consist of 12-12-12 or equivalent chemically combined fertilizer.

D. Staking and Guying. Stakes for plant material shall be either yard lumber of 2 by 4 inches nominal dimension, permitting small knots that do not impair serviceability, or steel posts meeting requirements of 115.4.09. The stakes shall be of the length specified in 2602.08.

F. Guying. Guying shall be a good commercial quality of galvanized No. 9 wire or 3/16-inch cable.

G. Pieces of new fabric-reinforced garden hose or an approved equal shall be used to protect the plants from damage by guys. Anchors used shall be constructed of steel of the sizes specified in 2602.08 as approved by the engineer.

H. Mulch shall be as specified on the plans or in special provisions.

## Section 4180. Paint Vehicles

**4180.01 GENERAL.** Unless otherwise specified, the raw materials for paint vehicles shall meet requirements of the following specifications for the respective material.

**4180.02 RAW LINSEED OIL.** ASTM D 231 shall apply.

**4180.03 LIQUID DRIER, CLASS B NAPHTHAVENTE.** ASTM D 600, Class B, shall apply.

**4180.04 MINERAL SPIRITS.** ASTM D 235 shall apply.

**4180.05 ALKYLID VARNISH NO. 2.** This alkylid resin solution shall meet requirements of FSS TT-R-266, Type I, Class A.

Addition

# PAINT PIGMENT

4181.01

## Section 4181. Paint Pigments

**4181.01 GENERAL.** Unless otherwise specified, the individual pigments for paints shall meet requirements of the following specifications for the respective material.

Lampblack  
Chrome oxide green  
Basic lead silicochromate  
Titanium dioxide

ASTM D 299  
ASTM D 293  
ASTM D 1638  
ASTM D 476

## Section 4182. Paints

**4182.01 GENERAL.** Paints shall be well ground, shall not cake, gel, skin, or badly settle in the container, and shall be readily redispersed with a paddle to a smooth, uniform product of proper consistency which allows drying without running, streaking, or sagging when applied to a smooth, clean, vertical, steel surface. Suitable paint additives shall be used to promote good package stability and to control the working characteristics of the paint to provide a satisfactory product. When specified, the paint shall match the color sample which will be furnished by the engineer.

The foliage green paint shall be composed of pigments and vehicles described in Sections 4180 and 4181.

**4182.02 ZINC-SILICATE PAINT.** This paint shall be either a two-component or catalyzed, single-component, self-cure ethyl silicate zinc-rich paint which cures without use of a separate curing solution. It is intended for use only on blast-cleaned steel and for spray application. Limited application by brush can be made. The paint shall meet the following requirements:

**A. Pigment.** The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other materials contained in the pigment or pigment component shall be inert.

**B. Vehicle.** The vehicle component of the two-component type shall have a storage life at 77 degrees F of not less than 12 months.

**C. Mixed Paint Properties.** The single-package paint or the two-component paint mixed in accordance with the manufacturer's instructions, shall meet the following requirements:

Weight per gallon at 77 degrees F, not less than 16.8 pounds.

Percent solids, by weight, not less than 67.0.

Percent solvent, by weight, not less than 32.0.

Percent volatile matter, by weight, not less than 70.0.

The two-component type shall have a useful life of not less than 6 months at 77 degrees F. The single-component type shall have a storage life of not less than 6 months. There shall be no settling of the pigment which cannot be resuspended during either the pre- or storage-life periods.

4182.06

# PAINTS

**D. Properties of Cured Coating.** The cured coating shall be of such color as to produce a distinct contrast with a blast-cleaned metal surface. In addition, the cured coating shall meet the following requirements when tested in accordance with Laboratory Test Method 811.

**Fresh water resistance.** The coating shall show no blistering or softening, and there shall be no rusting in the scribed lines at the end of the 30-day test period.  
**Salt water resistance.** After 500 hours of exposure, the coating shall show no loss of bond, nor shall there be any rusting of the test panel or blistering of the coating beyond 1/16 inch from the center of the scribed lines.  
**Resistance to elevated temperature and thermal shock.** There shall be no evidence of blistering or flaking of the coating after treatment.

**4182.03 VINYL FINISH COATING.** This paint shall be a one-package, high-build, vinyl paint so formulated to display compatibility with and adhesion to a cured coating of the zinc-silicate paint specified in 4182.02. The color shall match the foliage standard foliage green, or shall be white, whichever is required by the contract. It is intended for use only as a finish coat over zinc-silicate paint and primarily for spray application. It shall be made by the same manufacturer that makes the zinc-silicate paint over which it is applied. The paint shall meet the following requirements:

**A. Vehicle.** The vehicle shall consist essentially of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. Sulfuric plasticizers shall be included to insure adequate tensile strength of the paint film.

**B. Mixed Paint.** The paint shall air dry entirely from evaporation of the solvents and shall meet the following requirements:

Weight per gallon, pounds, at 77 degrees F.

Percent total solids, by weight, minimum

Percent vehicle solids, by weight, minimum

Drying time

1 to 2 hours - not more than 20 minutes

Dry through - not more than 4 hours

90-110

18

19

**4182.04 PRIMER FOR METAL.** This paint shall meet requirements of ASTM D 229, Type II (FSS TT-P-015, Type III). It is intended as a primer over ferrous metal surfaces and may be applied by spray, brush, or roller.

**4182.05 INTERMEDIATE COAT FOR METAL.** This paint shall meet requirements of 4182.01, except that the pounds of red iron oxide per 100 gallons of paint shall be replaced with lampblack to provide color contrast. It is intended as a second coat over the primer specified in 4182.01.

**4182.06 FOLIAGE GREEN PAINT.** This paint is intended as a finish coating over the intermediate coating specified in 4182.05. It shall match the foliage green color and meet the following requirements:

## 2508. PAINTING STRUCTURES.

ADD the following new paragraph to 2508.03:

Blast cleaning on an outdoor job site located in urban areas or other sensitive areas may be restricted to use of white silica sand. This shall be designated in the special provisions.

DELETE all of 2508.04 and add the following in lieu thereof:

**2508.04 PAINT SYSTEMS.** Except as herein modified, all surfaces to be painted shall receive one prime coat of zinc silicate paint with an average dry-film thickness of at least 3.0 mils and one coat of high-build vinyl finish coating of sufficient thickness to hide the prime coat and make the total average dry-film thickness of the two coats at least 6.0 mils. The minimum dry-film thickness of the prime coat measured at any point shall be 2.5 mils and the minimum total dry-film thickness of the two-coat system measured at any point shall be 5.0 mils. The color of the high-build, vinyl finish coating shall be foliage green, except as modified below.

For highway structures with ungalvanized steel rail elements above the floor and no structural steel elements above the floor, the entire rail and post elements shall receive the prime coat and a high-build, white vinyl finish coat. Steel posts and rails on structures designed to carry railway traffic shall receive the prime coat and a high-build, foliage green vinyl finish coat. On structures where the rail post is bolted to the top of the concrete curb, the joint between the steel base plate and the concrete shall be sealed with a 3/8- to 5/8-inch bead of white, elastomeric caulking compound.

All surfaces of structural steel elements above the floor or that extend above the floor, outside surfaces of exterior beams or girders, the bottom surface of the lower flange on exterior beams or girders, all surfaces on exterior elements of deck trusses, all surfaces of exterior bearing elements, and surfaces on exterior drain pipe, that are painted with foliage green, high-build, vinyl finish coating, shall receive one coat of foliage green, vinyl enamel. The dry-film thickness of the enamel coat shall be sufficient to hide the high-build vinyl coating and make the total average dry-film thickness of the three-coat system at least 7.0 mils and the minimum total dry-film thickness measured at any point at least 6.0 mils.

Nominal dry-film thicknesses of individual paint coats shall be as follows: prime coat, 3 mils; hi-build vinyl coat, 3 mils; and enamel coat, 1 mil.

The dry-film thickness of the coatings will be measured with a calibrated, magnetic, film-thickness gage. The engineer shall be afforded every opportunity to check the film-thickness after each coat of paint is applied.

DELETE the third sentence in 2508.05 and add the following in lieu thereof:

The dry-film thickness of the prime coat shall be 1.0 and 5.0 mils for contact surfaces of high-strength bolted connections in lieu of the thickness specified for the regular paint system.

ADD the following to the first paragraph of 2508.05:

For new structures, the prime coat shall be applied in the fabrication shop.

DELETE all of Article 2508.06 and add the following in lieu thereof:

**2508.06 FIELD PAINTING.** Unless otherwise specified, all structural steel that has received a prime coat, except contact surfaces, shall be painted after erection with the specified vinyl finish coats. When the specifications do not permit the steel to receive a prime coat in the shop before incorporation into the structure, the surfaces which will be exposed shall be cleaned and shall receive the prime coat after erection.

Before application of vinyl finish coats, all areas where the prime coat has been damaged during shipping, handling, and erection, areas that develop corrosion products before or after erection, and exposed surfaces of all rivets and other connectors installed in the field shall be cleaned as specified in 2508.03 and painted with zinc-silicate primer to a condition equal to that required for the prime coat applied in the shop.

Where surfaces have been painted with the full paint system before erection and the coatings are damaged so the prime coat is severely affected or where primer failure occurs on areas adjacent to vinyl-coated surfaces, the affected areas shall be cleaned, primed with an approved organic-vehicle, zinc-rich paint, and painted with the specified vinyl finish coats, before erection if applicable.

Old structures, to be repainted, shall be cleaned and painted with the full paint system as specified herein. When continuous I-beam or welded girder structures are being repainted, the cracks formed between splice plates, fill plates, webs and flanges on the outside surfaces of exterior beams shall be sealed with a small bead of compatible, elastomeric caulking compound after the primer has been applied and before application of vinyl paint. The extent of painting to be performed may be stipulated in the proposal or special provisions for the project.

On completion of all painting, the word "painted" followed by the month and year shall be permanently stenciled on an inconspicuous surface in a manner and location approved by the engineer.

DELETE the second sentence in 2508.07 and add the following in lieu thereof:

Paint shall not be applied when the temperature of the metal or primed surface is below 40 degrees F.

DELETE all of 2508.10 and add the following in lieu thereof:

**2508.10 CURING TIME.** The coat of zinc silicate paint shall be thoroughly cured, as indicated by coin hardness, before applying the vinyl finish coat or before the metal is loaded for shipment. In any case, zinc silicate paint shall not be topcoated with vinyl paint during the same day the primer is applied.

DELETE all of Article 2508.11 and add the following in lieu thereof:

**2508.11 TRAFFIC PROTECTION AND POLLUTION CONTROL.** The contractor shall use every reasonable means to protect the environment, persons, adjacent property, and vehicles from damage because of his operations, in accordance with 1107.07, 1107.08, and 1107.09. When repainting old structures, traffic control and pollution control measures shall be as follows:

- A. **Traffic Control.** When the contract is for painting only, the road shall be kept open to traffic, and no work will be permitted on Sundays or holidays. The contractor may restrict traffic to one lane (the restriction shall not be more than half the roadbed), if necessary, from 1/2 hour after sunrise to 1/2 hour before sunset, but he shall permit traffic to pass safely at all times, except for occasional, unavoidable interruptions.

The contractor shall provide two flagmen or traffic-control signals to direct traffic at any time he restricts traffic from a traffic lane on a two-way roadway or when traffic is delayed by unavoidable interruptions.

The contractor shall place and maintain traffic-warning devices each way from the work. Where traffic control is incidental, the signs only will be furnished by the contracting authority, free of charge to the contractor at the maintenance garage for that area, but they shall be placed and removed, as necessary, by the contractor, and returned when work is completed, in accordance with 1107.09. The contractor shall notify the local foreman two days in advance of the date the signs will be needed. When the contract includes an item for traffic control, 1107.09 shall apply.

Any equipment or supplies that obstruct the roadbed during the day shall be removed as far from the traveled way as is practical from 1/2 hour before sunset to 1/2 hour after sunrise, and the roadbed shall be open full width to permit normal traffic.

- B. **Pollution Control.** Specific pollution control and environmental protection procedures may be required by the special provisions.

#### 4180. PAINT VEHICLES.

ADD the following new Article to Section 4180:

**4180.06 VINYL RESINS.** The vinyl resins shall be vinyl chloride-acetate copolymers produced by a solution polymerization process and shall have film-forming properties. The vinyl resins shall meet the following composition requirements for the type designated:

Vinyl Resin Type 1. The resin shall contain 85 to 88% vinyl chloride and 12 to 15% vinyl acetate, by weight.

Vinyl Resin Type 2. The resin shall contain 1% interpolymerized dibasic acid, 81.5 to 87% vinyl chloride, and 12 to 17.7% vinyl acetate, by weight.

Vinyl Resin Type 3. The resin shall contain 5.3% to 6.5% hydroxyl, 89.5 to 91.5% vinyl chloride, and 2.0 to 5.3% vinyl acetate, by weight.

#### 4182. PAINTS.

DELETE the second paragraph in 4182.01 and add the following in lieu thereof:

The pigments and vehicles specified for vinyl finish coatings and the foliage green paint shall meet applicable requirements of 4180 and 4181.

DELETE all of Article 4182.03 and substitute the following in lieu thereof:

**4182.03 VINYL FINISH COATINGS.** These specifications cover one-package, vinyl paints of the high-build and enamel types for use as finish coats on bridges.

The high-build vinyl paint shall be formulated to display compatibility with and adhesion to a cured coating of the zinc silicate paint specified in 4182.02. The color shall match Iowa standard foliage green, or shall be white, as may be required. It is for use as a finish coat over zinc silicate paint or as an intermediate coat between zinc silicate primer and a vinyl enamel finish coat.

The vinyl enamel shall be formulated to display compatibility with and adhesion to a cured coating of high-build vinyl paint described herein. The color shall match Iowa standard foliage green. It is for use over high-build vinyl and not for use over zinc silicate primer.

The paints shall meet the following requirements:

A. Vehicle. The vehicle for each paint shall primarily consist of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. The vehicles shall be plasticized with a pure chemical plasticizer of the phosphate type and shall be stabilized with an epoxy resin stabilizer. The vehicle solids shall have the following composition with a tolerance for each ingredient of plus or minus one percent:

	Hi-Build	Enamel
Vinyl Resin, Type 1, percent	19.0	48.0
Vinyl Resin, Type 2, percent	48.7	16.0
Vinyl Resin, Type 3, percent	-	15.0
Plasticizer, percent	22.9	11.4
Epoxy Resin Stabilizer, percent	9.4	8.8

B. Pigment Composition. The pigment portion of the individual paints shall meet the following requirements:

	Fol. Green Hi-Build	White Hi-Build	Fol. Green Enamel
Total chrome oxide green and rutile titanium dioxide, % minimum	29.0	-	67.0
Rutile titanium dioxide, % minimum	-	54.0	-

The remainder shall be tinting and extender pigments except the vinyl enamel shall not contain extender pigments.

C. Mixed Paint. The finished paints shall meet the following requirements:

	Hi-Build	Enamel
Pounds per gallon at 77 degrees F, minimum	9.7	9.0
Percent pigment by weight, minimum	29.0	16.0
Percent vehicle solids by weight, minimum	19.0	19.0
Specular Gloss, 60 degrees, minimum	-	30
Dry time, set to touch, minutes, minimum	20	20

OCT. 1 1979

# KANSAS DEPARTMENT OF TRANSPORTATION

STATE OFFICE BUILDING—TOPEKA, KANSAS 66612



JOHN B. KEMP, Secretary of Transportation

JOHN CARLIN, Governor

September 27, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, Virginia 22042

4 OCT 1 1979

Dear Mr. Ordway:

In accordance with your request, we are attaching copies of the following zinc-rich paint specifications:

1. 1008.09 Zinc Rich Paint for Repairing Damaged Spelter Coating,
2. 73P-241 Bridge Painting (Inorganiz Zinc-Vinyl System).

Very truly yours,

J. M. HEMPHILL, P.E.  
ENGINEER OF MATERIALS

JAMES M. BROWN, P.E.  
STAFF ASSISTANT

JMB:cah  
Attachments



## MATERIALS DETAILS

### 1005.09 ZINC RICH PAINT FOR REPAIRING DAMAGED SPELTER COATING

(a) **COMPOSITION**—Zinc Rich Paint shall consist of zinc dust pigment with suitable resins, oils, and solvents, and shall conform to the following.

(b) **REQUIREMENTS**—Zinc Rich Paint shall conform with all of the requirements of MILITARY SPECIFICATIONS MIL-P-21035 (SHIPS) PAINT, HIGH ZINC DUST CONTENT, GALVANIZING REPAIR dated August 23, 1957, with the following additions and exceptions:

(1) The paint shall be supplied ready mixed. Material supplied in two compartment cans to be mixed on the job will not be accepted.

(2) Pigment content expressed as a weight percent of total-non-volatile content may be a minimum of 92.0 instead of the 94.0 minimum required by the military specification.

(3) Percent metallic zinc by analysis in the pigment may be a minimum of 94.0 instead of the 97.5 minimum required by the military specification.

(c) **BASIS OF ACCEPTANCE**—This material will be accepted on basis of receipt of a Type D certification in accordance with Section 1016 of the Standard Specifications.

KANSAS DEPARTMENT OF TRANSPORTATION  
SPECIAL PROVISION  
TO THE  
STANDARD SPECIFICATIONS  
EDITION OF 1973

NOTE: WHENEVER THIS SPECIAL PROVISION CONFLICTS WITH THE PLANS, SUPPLEMENTAL SPECIFICATIONS OR STANDARD SPECIFICATIONS, THIS SPECIAL PROVISION SHALL GOVERN.

BRIDGE PAINTING  
(INORGANIC ZINC-VINYL SYSTEM)

1.0 DESCRIPTION: THIS WORK SHALL CONSIST OF PREPARATION OF SURFACES TO BE PAINTED, FURNISHING AND APPLYING SPECIFIED PAINTS, PROTECTION AND DRYING OF PAINT COATINGS, FURNISHING PROTECTION FROM PAINT SPATTER AND DISFIGUREMENT, AND FINAL CLEANUP, ALL IN CONFORMITY WITH THIS SPECIFICATION.

2.0 MATERIALS: ALL MATERIAL SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:

2.1 INORGANIC ZINC SILICATE PAINT -

2.1.1 DESCRIPTION. INORGANIC ZINC SILICATE PAINT SHALL BE EITHER A TWO-COMPONENT OR A ONE-COMPONENT SELF-CURING TYPE WHICH, WHEN MIXED, AND APPLIED IN ACCORDANCE WITH THE REQUIREMENTS WITH SECTION 4 BELOW, CURES WITHOUT THE USE OF A SEPARATE CURING SOLUTION, AND SHALL HAVE THE PROPERTIES DESCRIBED HEREIN.

2.2 COMPOSITION - TWO COMPONENT TYPE

2.2.1 PIGMENT COMPONENT. THE ZINC PORTION OF THE PIGMENT SHALL BE OF A FINELY DIVIDED ZINC POWDER CONTAINING, BY WEIGHT, A MINIMUM OF 96 PERCENT METALLIC ZINC AND 95 PERCENT TOTAL ZINC. ALL OTHER FILLERS SHALL BE INERT SUBSTANCES.

2.2.2 VEHICLE COMPONENT. THE VEHICLE COMPONENT SHALL CONSIST PRIMARILY OF PARTIALLY HYDROLYZED ETHYL SILICATE IN AN APPROPRIATE SOLVENT AND SHALL HAVE THE FOLLOWING PROPERTIES:

(A) NON-VOLATILE MATERIAL PERCENT .....	39 - 43
(B) SILICON DIOXIDE, PERCENT OF VEHICLE .....	9.0 - 12.0
(C) WEIGHT PER GALLON, POUNDS .....	9.2 - 9.6
(D) STORAGE LIFE, AT 77° F, MONTHS .....	12 MINIMUM

2.2.3 MIXED PAINT. MIXED PAINT SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:

- (A) ZINC BY WEIGHT IN THE DRIED FILM, PERCENT 75 MINIMUM.
- (B) TOTAL SOLIDS BY WEIGHT, PERCENT 72 MINIMUM.
- (C) THE PAINT SHALL TOLERATE UP TO ONE PERCENT WATER CONTAMINATION WITHOUT GELATION.
- (D) THE USABLE POT LIFE OF THE MIXED PAINT SHALL BE NOT LESS THAN 8 HOURS AT 77° F. THERE SHALL BE NO HARD SETTLING WHICH CANNOT BE EASILY REDISPERSED DURING THIS PERIOD.

2.3 COMPOSITION - ONE COMPONENT TYPE

2.3.1 NON VOLATILE MATERIAL, PERCENT ..... 67.5 MINIMUM

2.3.2 WEIGHT PER GALLON POUNDS ..... 17.0 - 18.5

2.3.3 ZINC BY WEIGHT IN THE DRIED FILM PERCENT ..... 81 MINIMUM  
ACCORDING TO FEDERAL STANDARD 141 METHOD 7221.

2.3.4 STORAGE LIFE WITHOUT GELATION ..... 6 MONTHS  
THERE SHALL BE NO HARD SETTLING DURING THIS PERIOD WHICH CANNOT BE EASILY DISPERSED.

2.4 THE INORGANIC ZINC COATING SHALL BE SO FORMULATED AS TO PRODUCE A DISTINCT CONTRAST IN COLOR WITH THE BLAST CLEANED METAL SURFACES AND WITH THE VINYL FINISH COAT.

2.5 RESISTANCE TESTS - TEST PANELS OF STEEL MEETING THE REQUIREMENTS OF ASTM D 609-61 (196F) HAVING DIMENSIONS OF 2 BY 5 INCHES BY 1/8 INCH, SHALL BE PREPARED BY CLEANING ALL SURFACES TO THE SAME DEGREE SPECIFIED IN SECTION 4.0 BELOW.

A 3-MIL COATING (DRY THICKNESS) SHALL THEN BE APPLIED TO THE TEST PANELS IN ACCORDANCE WITH THE MANUFACTURER'S CURRENT PRINTED INSTRUCTIONS. THE COATING SHALL BE CURED AS RECOMMENDED BY THE MANUFACTURER. EACH OF THE FOLLOWING TESTS SHALL BE PERFORMED ON ONE OR MORE TEST PANELS. THE MATERIAL WILL NOT BE ACCEPTED IF ANY INDIVIDUAL TEST PANEL FAILS ANY OF THE FOLLOWING TESTS:

2.5.1 FRESH WATER RESISTANCE. PANELS SHALL BE SCRIBED DOWN TO BASE METAL WITH AN X OF AT LEAST 2-INCH LEGS AND SHALL BE IMMersed IN FRESH TAP WATER AT  $75\text{ F} \pm 5\text{ F}$ . THE PANELS SHALL SHOW NO RUSTING, BLISTERING OR SOFTENING WHEN EXAMINED AFTER 30 DAYS.

2.5.2 SALT FOG RESISTANCE. PANELS SHALL BE SCRIBED WITH AN X OF AT LEAST 2-INCH LEGS DOWN TO BASE METAL. THE TEST PANELS SHALL THEN BE TESTED IN ACCORDANCE WITH ASTM 6117-73. AFTER 1000 HOURS OF EXPOSURE, THE COATING SHALL SHOW NO LOSS OF BOND, NOR SHALL IT SHOW RUSTING OR BLISTERING BEYOND 1/16 INCH FROM THE CENTER OF THE SCRIBE MARK.

2.5.3 RESISTANCE TO ELEVATED TEMPERATURES AND THERMAL SHOCK. PANELS SHALL BE EXPOSED TO A TEMPERATURE OF 500 F FOR ONE HOUR, THEN QUENCHED IMMEDIATELY IN  $65\text{ F} \pm 5\text{ F}$  WATER. PANELS SUBJECTED TO THIS TEST SHALL SHOW NO BLISTERING OR FLAKING OF THE COATING.

2.5.4 PACKAGING AND LABELING. TWO COMPONENT PAINT SHALL BE PACKAGED IN TWO-COMPARTMENT CONTAINERS OR IN TWO SEPARATE CONTAINERS. THE COMPONENTS SHALL BE PACKAGED IN SUCH PROPORTIONS THAT THE PIGMENT MIXED WITH THE VEHICLE, WILL YIELD 5 GALLONS OF MIXED PAINT.

ALL CONTAINERS SHALL BE NEW METAL PAILS, FREE OF PHYSICAL DEFECTS, AND OF SUCH TYPE AS TO PREVENT ATTACK BY THE PAINT OR PAINT COMPONENTS. EACH CONTAINER SHALL BEAR A LABEL CLEARLY SHOWING THE NAME OF MANUFACTURER, BRAND NAME OF PAINT, LOT NUMBER, DATE OF MANUFACTURE, NET WEIGHT OF CONTENTS AND COMPLETE INSTRUCTIONS AND PRECAUTIONS FOR THEIR USE.

## 2.6 VINYL FINISH COATING -

2.6.1 DESCRIPTION. VINYL PAINT FOR FINISH COAT SHALL BE MANUFACTURED BY THE MANUFACTURER OF THE INORGANIC ZINC PRIMER. IT SHALL BE A ONE-PACKAGE, HIGH BUILD VINYL PAINT SO FORMULATED TO DISPLAY COMPATIBILITY WITH AND ADHESION TO THE CURED INORGANIC ZINC PRIMER. IT SHALL BE WELL GROUND AND SHALL NOT BE CAKED, GELLED, SKINNED OR BADLY SETTLED IN THE CONTAINER.

### 2.6.2 COMPOSITION.

2.6.2.1 VEHICLE. THE VEHICLE SHALL CONSIST ESSENTIALLY OF VINYL CHLORIDE-VINYL ACETATE COPOLYMER RESINS DISSOLVED IN SUITABLE SOLVENTS. SUFFICIENT PLASTICIZERS SHALL BE INCLUDED TO INSURE THAT THE PAINT FILM WILL HAVE ADEQUATE TENSILE STRENGTH.

#### 2.6.2.2 MIXED PAINT.

(A) VINYL PAINT FOR THE FINISH COAT SHALL CONTAIN NOT LESS THAN 29 PERCENT PIGMENT BY WEIGHT AND 19 PERCENT VEHICLE SOLIDS BY WEIGHT, FOR A TOTAL SOLIDS CONTENT OF NOT LESS THAN 48 PERCENT BY WEIGHT. TOTAL WEIGHT PER GALLON AT 77 F SHALL BE  $10.0 \pm 1.0$  POUNDS.

(B) THE VINYL PAINT SHALL SET TO TOUCH IN NOT MORE THAN 20 MINUTES AND SHALL DRY THROUGH IN NOT MORE THAN 4 HOURS.

(C) THE VINYL FINISH COAT SHALL BE DARK GREEN, MATCHING KANSAS DEPARTMENT OF TRANSPORTATION ADMINISTRATION STANDARD COLOR NUMBER 1008G-1.

2.7 PREQUALIFICATION - THE INORGANIC ZINC PRIMER AND VINYL FINISH COAT SHALL BE PREQUALIFIED BY THE KANSAS DEPARTMENT OF TRANSPORTATION. A QUALIFICATION LIST WILL BE MAINTAINED BY THE ENGINEER OF MATERIALS. QUALIFICATION SAMPLES SHALL BE SUBMITTED TO THE ENGINEER OF TESTS, KANSAS DEPARTMENT OF TRANSPORTATION, 2300 VAN BUREN STREET, TOPEKA, KANSAS 66611.

2.8 SAMPLING AND TESTING - UNLESS OTHERWISE SPECIFIED, PAINTS AND PAINT MATERIALS SHALL BE SAMPLED AND TESTED ACCORDING TO THE APPLICABLE SECTIONS OF FEDERAL TEST STANDARD NO. 141, "METHODS OF INSPECTION, SAMPLING AND TESTING PAINT, VARNISH, LACQUER AND RELATED PRODUCTS", AND THE APPLICABLE SECTIONS OF ASTM STANDARDS ON PAINT, VARNISH AND RELATED PRODUCTS. WHERE DIFFERENT METHODS OR ALTERNATE METHODS ARE GIVEN, THE KANSAS DEPARTMENT OF TRANSPORTATION RESERVES THE RIGHT TO SELECT THE METHOD.

3.0 BASIS OF ACCEPTANCE: ACCEPTANCE OF MATERIAL FURNISHED UNDER THIS SPECIFICATION WILL BE BASED ON RECEIPT AND APPROVAL OF A TYPE D CERTIFICATION AS SPECIFIED IN SECTION 1016 OF THE 1973 STANDARD SPECIFICATION. CHECK TESTS AS DETERMINED BY THE ENGINEER MAY BE CONDUCTED BY THE STATE ON SAMPLES OBTAINED AT THE PROJECT SITE.

#### 4.0 SHOP PAINTING:

4.1 SURFACE PREPARATION - SURFACES TO BE PAINTED SHALL BE BLAST CLEANED WITH ABRASIVES PRODUCING A HEIGHT OF PROFILE OF 1-3 MILS. THE BLAST CLEANED SURFACES SHALL MEET THE FOLLOWING REQUIREMENTS:

4.1.1 ALL OIL, GREASE, DIRT, RUST SCALE AND OTHER FOREIGN MATTER SHALL BE COMPLETELY REMOVED EXCEPT AS HEREINAFTER MODIFIED.

4.1.2 ALL RUST, MILL SCALE AND OLD PAINT SHALL BE REMOVED EXCEPT THAT VERY LIGHT SHADOWS, STREAKS OR DISCOLORATIONS CAUSED BY RUST STAINS OR MILL SCALE OXIDES, OR SLIGHT, TIGHT RESIDUES OF PAINT MAY REMAIN.

4.1.3 IF THE SURFACE IS PITTED, SLIGHT RESIDUES OF RUST OR PAINT MAY REMAIN IN THE BOTTOM OF PITS.

4.1.4 AT LEAST TWO THIRDS OF EACH SQUARE INCH OF SURFACE SHALL BE FREE OF ALL VISIBLE RESIDUES AND THE REMAINDER SHALL BE LIMITED TO THE LIGHT DISCOLORATION, SLIGHT STAINING, OR SLIGHT RESIDUES MENTIONED ABOVE.

4.1.5 SURFACES SHALL BE CLEANED TO A CONDITION AT LEAST EQUAL TO THE APPEARANCE OF THE PICTORIAL SURFACE PREPARATION STANDARD, LABELED SA 2 IN ASTM D 2200-67, THAT APPLIES TO THE STARTING RUST GRADE OF THE STEEL.

SURFACES CLEANED TO MEET STEEL STRUCTURES PAINTING COUNCIL SPECIFICATION SSPC-SP 6-63 WILL MEET THESE REQUIREMENTS.

AFTER BLAST CLEANING, THE SURFACES SHALL BE BRUSHED WITH CLEAN BRUSHES, BLOWN OFF WITH COMPRESSED AIR, OR CLEANED BY VACUUM TO REMOVE ANY TRACE OF BLAST PRODUCTS ON THE SURFACE, AND ALSO FOR THE REMOVAL OF ABRASIVES FROM POCKETS AND CORNERS. THE BLAST CLEANED SURFACES SHALL BE GIVEN A PRIME COAT OF PAINT WITHIN 24 HOURS AFTER CLEANING. IF CLEANED SURFACES RUST BEFORE COATING IS ACCOMPLISHED, THEY SHALL BE RECLEANED BY THE CONTRACTOR AT HIS EXPENSE.

4.2 WEATHER CONDITIONS. PAINT SHALL NOT BE APPLIED WHEN THE AIR TEMPERATURE IS BELOW 40° F, EXCEPT THAT INORGANIC ZINC PAINTS MAY BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AT TEMPERATURES NOT LESS THAN 25° F, WHEN THE AIR IS MISTY, OR WHEN IN THE OPINION OF THE ENGINEER, CONDITIONS ARE OTHERWISE UNSATISFACTORY FOR THE WORK. IT SHALL NOT BE APPLIED UPON DAMP OR FROSTED SURFACES. MATERIAL PAINTED UNDER COVER DURING DAMP OR COLD WEATHER SHALL REMAIN UNDER COVER UNTIL DRY OR UNTIL WEATHER CONDITIONS PERMIT ITS EXPOSURE IN THE OPEN. APPLICATION SHALL CEASE WHEN, IN THE OPINION OF THE ENGINEER, THE AIR TEMPERATURE IS SO HIGH THAT THE SPRAY DRIES BEFORE REACHING THE SURFACE, RESULTING IN A DRY POWDERY COATING.

4.3 MIXING OF PAINT. PAINT SHALL BE THOROUGHLY MIXED BEFORE APPLYING, AND THE PIGMENT SHALL BE KEPT IN SUSPENSION. AFTER INITIAL MIXING, THE PAINT SHALL BE STRAINED THROUGH A METAL SCREEN NOT COARSER THAN 30 MESH NOR FINER THAN 60 MESH. UNUSED MATERIAL MAY BE MIXED AND USED THE DAY FOLLOWING INITIAL MIXING SO LONG AS THE PIGMENT CAN BE EASILY REDISPERSED, UNLESS PROHIBITED BY THE MANUFACTURER'S INSTRUCTIONS.

4.4 THINNING PAINT. THINNING WILL BE PERMITTED WHEN REQUIRED FOR PROPER APPLICATION BUT IN NO CASE SHALL MORE THINNER BE ADDED THAN RECOMMENDED BY THE MANUFACTURER. WHEN THINNER IS USED IT SHALL BE ADDED TO THE PAINT DURING THE MIXING PROCESS. PAINTERS SHALL NOT ADD THINNER TO PAINT AFTER IT HAS BEEN THINNED TO THE CORRECT CONSISTENCY. THINNER FOR VINYL AND INORGANIC ZINC PAINTS SHALL BE AS RECOMMENDED BY THE MANUFACTURER. IF IT IS NECESSARY IN COOL WEATHER TO THIN THE PAINT ON ACCOUNT OF CONGEALING, THIS SHALL BE DONE BY HEATING IN HOT WATER OR ON STEAM RADIATORS, OR BY OTHER METHODS APPROVED BY THE ENGINEER.

4.5 APPLICATION OF PAINT. UNLESS OTHERWISE INDICATED ON THE PLANS OR IN THE PROPOSAL, ALL STRUCTURAL STEEL SHALL RECEIVE ONE COAT OF INORGANIC ZINC SILICATE PAINT IN THE SHOP. PAINTING SHALL BE DONE IN A WORKMANLIKE MANNER USING A PNEUMATIC SPRAY. THE INORGANIC ZINC COATING SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTION.

WHEN FABRICATION IS COMPLETED AND ACCEPTED, SURFACES NOT PAINTED BEFORE ASSEMBLING, SHALL BE PAINTED WITH ONE SHOP COAT. ALL SURFACES OF THE STRUCTURAL STEEL SHALL BE COATED INCLUDING CONTACT SURFACES OF HIGH STRENGTH BOLTED CONNECTIONS AND AREAS IN CONTACT WITH CONCRETE. THE DRY FILM THICKNESS SHALL BE 1.0 TO 1.5 MILS FOR CONTACT SURFACES OF HIGH STRENGTH BOLTED CONNECTIONS AND TOPS OF BEAMS AND GIRDERS REGARDLESS OF THE THICKNESS SPECIFIED FOR THE SYSTEM. ALL METAL SURFACES WITHIN TWO (2) INCHES OF FIELD WELDS SHALL NOT RECEIVE THE SHOP COAT UNTIL AFTER FIELD WELDING IS COMPLETED. THE MINIMUM DRY FILM THICKNESS OF THE SHOP COAT SHALL BE THREE (3) MILS. THE PAINT SHALL BE APPLIED SO THAT IT DOES NOT RUN, SAG, CRAWL OR HAVE OTHER DEFECTS. MATERIAL SHALL NOT BE LOADED FOR SHIPMENT UNTIL THE PAINT IS DRY.

THE PAINT WHEN APPLIED SHALL BE SO MANIPULATED AS TO PRODUCE A UNIFORM EVEN COATING IN CLOSE CONTACT WITH THE METAL OR PREVIOUSLY APPLIED PAINT AND SHALL BE WORKED INTO ALL CORNERS AND CREVICES.

4.6 REMOVAL OF PAINT. IF DEFICIENCIES IN THE QUALITY OF WORK OR MATERIALS REQUIRE REJECTION, THE CONTRACTOR SHALL, UNLESS OTHERWISE APPROVED, BLAST CLEAN THE ENTIRE REJECTED AREA OF ALL PREVIOUSLY APPLIED MATERIAL PRIOR TO RECOATING.

4.7 INACCESSIBLE SURFACES. SURFACES NOT IN CONTACT BUT WHICH WILL BE INACCESSIBLE AFTER ASSEMBLING OR ERECTION SHALL BE PAINTED TWO COATS TO PRODUCE A TOTAL DRY FILM THICKNESS OF NOT LESS THAN 6.0 MILS.

4.8 ERECTION MARKS. NO PAINT SHALL BE APPLIED OVER ERECTION MARKS, INCLUDING DIE MARKS, UNTIL AFTER ERECTION.

4.9 MACHINED SURFACES SUCH AS BEARING PIN, ROCKERS, BOLSTERS, MACHINERY PLATES, ETC., SHALL BE THOROUGHLY CLEANED OF MACHINE TOOL CUTTING OIL, THEN CAREFULLY MASKED PRIOR TO BLASTING. THE MASKING SHALL BE REMOVED AND THE ENTIRE PART SHALL BE PAINTED AS SPECIFIED ON THE PLANS.

## 5.0 FIELD PAINTING:

5.1 RENEWING SHOP COAT. WHEN A SHOP COAT HAS BEEN APPLIED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD TOUCH UP OF THE SHOP COAT INCLUDING CLEANING AND PAINTING OF FIELD CONNECTIONS, WELDS OR BOLTS AND ALL DAMAGED OR DEFECTIVE PAINT OR RUSTED AREAS. THE TOUCH-UP FIELD COAT SHALL BE MADE WITH ONE (1) COAT OF THE SAME PAINT AS WAS USED FOR THE SHOP COAT.

5.2 NUMBER OF APPLICATIONS. UNLESS OTHERWISE SPECIFIED ON THE PLANS, FIELD PAINTING SHALL CONSIST OF ONE (1) COAT APPLIED AFTER ERECTION. VINYL FINISH COAT SHALL BE USED FOR THE FINAL FIELD COAT. THE MINIMUM DRY FILM THICKNESS OF THE FINAL COAT SHALL BE 3.0 MILS. THE FINAL FIELD COAT SHALL BE APPLIED SO THAT IT DOES NOT RUN, SAG, CRAWL OR HAVE OTHER DEFECTS.

5.3 APPLICATION OF FIELD PAINT. THE GENERAL REQUIREMENTS FOR PAINTS, THEIR MIXING AND APPLICATION, WEATHER CONDITIONS, CLEANING OF SURFACES TO BE PAINTED AND QUALITY OF WORKMANSHIP, AS SPECIFIED FOR SHOP PAINTING SHALL APPLY TO FIELD PAINTING. VINYL PAINT SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S CURRENT INSTRUCTIONS, WHICH SHALL BE FURNISHED TO THE ENGINEER. THE CONTRACTOR SHALL FURNISH AND USE ADEQUATE STAGING AND SCAFFOLDING SATISFACTORY TO THE ENGINEER AND NO CLIMBING OVER OR WORKING ON FINISHED PAINTED MEMBERS WILL BE PERMITTED.

5.4 PROTECTION OF PROPERTY. THE CONTRACTOR SHALL PROTECT PEDESTRIAN, VEHICULAR AND OTHER TRAFFIC UPON OR UNDERNEATH THE BRIDGE, ALL ADJOINING PROPERTY ALONG THE RIGHT-OF-WAY, ALL PIPES OR DUCTS OWNED BY UTILITY COMPANIES, AND ALSO ALL PORTIONS OF THE BRIDGE SUPERSTRUCTURE AND SUBSTRUCTURE AGAINST DAMAGE OR DISFIGUREMENT BY SPATTERS, SPLASHES, SMIRCHES AND SPRAY OF PAINT MATERIALS. ANY DAMAGE SO RESULTING SHALL BE ENTIRELY THE RESPONSIBILITY OF THE CONTRACTOR.

5.5 REMOVAL OF PAINT. ANY METAL COATED WITH IMPURE OR UNAUTHORIZED PAINT SHALL BE THOROUGHLY CLEANED AND REPAINTED TO THE SATISFACTION OF THE ENGINEER, AT THE EXPENSE OF THE CONTRACTOR.

6.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT: THIS WORK WILL NOT BE MEASURED OR PAID FOR DIRECTLY BUT SHALL BE CONSIDERED SUBSIDIARY TO STRUCTURAL STEEL.

5-9-77

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Kentucky Spec. received from Mr. John E. McChord  
October 19, 1979

(2)

## SPECIAL NOTE FOR INORGANIC ZINC RICH PRIMER

### DESCRIPTION

This Special Note covers requirements for an inorganic zinc silicate paint, to be used as a prime coat on structural steel.

### II. REQUIREMENTS

A. General. The inorganic zinc rich primer shall be a 2-component self curing type which cures without the use of a separate curing solution. This paint shall be furnished by an established manufacturer of zinc silicate paint.

#### B. Composition.

1. Zinc Dust -- The zinc component shall be a finely divided zinc powder containing, by weight, a minimum of 93 percent metallic zinc and a minimum of 96 percent total zinc. All other fillers contained in the zinc component shall be inert substances. No toning pigment should be included. The average particle size shall be 4-9 microns.

2. Base Component -- The base component shall consist primarily of a partially hydrolyzed ethyl or alkyl silicate in an appropriate alcohol solvent.

#### 3. Properties of Mixed Paint --

(a) The total zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.

(b) The total solids, when heated at 105 degrees C for three hours shall be no less than 70 percent by weight.

(c) The paint shall tolerate up to one percent water contamination by weight without gelation within 5 minutes.

(d) The usable pot life of the mixed paint shall be no less than 8 hours at 77 degrees F. There shall be no hard settling which cannot be easily redispersed during this period.

(e) Weight per gallon, pounds at 77 degrees F: 17.0 minimum.

C. Color. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish coat.

D. Packaging. Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle will yield five gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint and the lot number. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

(3)

E. Approval. Each shipment of the inorganic zinc rich primer shall be accompanied by notarized test reports from an independent laboratory showing actual test results conforming to all requirements herein. The test reports shall show the manufacturer's name, brand name of paint, lot tested, and date of manufacture.

Each shipment shall also be accompanied by a certification from the manufacturer that the material furnished is formulated the same as the material upon which the testing was performed.

The Bureau will sample each shipment in accordance with the Bureau's "Manual of Field Sampling and Testing Practices", and may perform whatever testing deemed necessary. Material will be rejected at any time that actual tests show that the material does not conform to the requirements herein.

F. Application. The inorganic zinc primer shall be applied in strict accordance with the manufacturer's written instructions. Copies of the manufacturer's application instructions shall be furnished to the Engineer before painting is begun.

The Contractor shall furnish a representative of the zinc paint manufacturer when application begins, to observe the initial application and advise the Engineer and the Contractor as to proper application techniques, and when proper results are being obtained.

Dry film thickness of the prime coat shall be 3.0 mils  $\pm$  0.5 mil.

The zinc primer shall not be covered by an additional coat of paint until at least 2 hours have elapsed, or such other time as may be recommended in writing by the paint manufacturer.

May 16, 1979



ARTECH CORP. 2901 Telestar Court Falls Church, Virginia 22042 (703) 560-3292

September 19, 1979

Mr. Merle Bukler, Supervisor  
Office of Materials and Testing  
Dept. of Transportation  
Pierre, South Dakota 75701

Dear Sir:

We are compiling for the Navy a comparison of all the specifications now in use or proposed for zinc-rich paints or primers (both the inorganic and organic types). If you have such a specification, we should very much like to obtain a copy. If you employ a specification issued by a national organization, such as the Steel Structures Painting Council, a reference to their designation would also be appreciated. The information should be addressed for my attention - a return envelope is enclosed.

We are grateful for your cooperation. The results will benefit our Navy and ultimately will help to improve the quality and economy of the nation's rust-protection technology.

Sincerely yours,

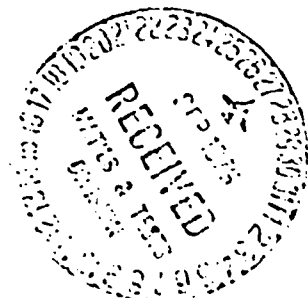
ARTECH CORP.

*Fred Ordway*

Fred Ordway  
Executive Vice President

*no specifications  
for zinc-rich paints*

FO/jb



STATE OF MAINE  
DEPARTMENT OF TRANSPORTATION

ADDRESS REPLY TO: MAINE DEPARTMENT OF TRANSPORTATION

September 28, 1979

OCT. 1 1979

4 OCT 1979

Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Hills Church, Virginia 22042

Dear Mr. Ordway:

Enclosed is a copy of our proposed specifications for self-curing inorganic zinc. We are still awaiting further documentation before we can determine what is the most cost effective percentage by weight of zinc in the dry film to specify. At this time we are undecided as to whether we should specify 82% or 86% zinc. We had previously specified 86% and may well stay with that percentage.

Very truly yours,

Frederick M. Boyce,  
Engr. H & S

*David S. Longland*  
By David S. Longland  
Paint Technician

/bep

Sept. 25, 1979

SPECIAL PROVISIONS  
SECTION 506  
PAINTING STRUCTURAL STEEL  
(Self-Curing Inorganic Zinc and Vinyl)

The requirements of this section shall apply except as follows:

DESCRIPTION. This work shall include the surface preparation and a single application of an Inorganic Zinc shop coating to all structural steel surfaces, including the interfaces of bolted connections and bearing pedestals, except areas to be field welded shall not receive shop paint. No other shop coating will be required. Subsequently, field welded areas and damaged areas shall be touched up in the field with an Aluminum Epoxy Plastic or with another appropriate coating that is compatible with the primer and the vinyl finish coat and has been recommended by the paint producer and approved by the Department. All exposed surfaces of structural steel, shall be given one Vinyl Finish Coat applied after erection is complete.

TECHNICAL SUPERVISION. Technical assistance by the paint manufacturer's representative will be required for field and shop applications. No separate payment for the supervision by the manufacturer's representative will be made. The cost will be considered to be incidental to the contract lump sum price for Item No. 506.14.

MATERIALS

GENERAL. The Inorganic Zinc paint shall be prequalified by the Department prior to approval. If the paint has not been previously prequalified by the Department, a sample of at least one quart, when mixed, shall be submitted to the Engineer for testing and prequalification. The Contractor shall allow 40 days for testing of the paint.

The Contractor shall submit to the Engineer for approval the batch formula (generic rather than trade names and in weight proportions and total gallons per batch) and a Certified Batch Test at least 10 days before releasing an order with the manufacturer of the paint for shipment.

The Engineer shall have free access afforded to him for sampling of the ingredients entering into the paint and for observing the weighing of the raw materials going into the batches and the process of the manufacture. Samples may be subject to chemical analysis and, if found of unsatisfactory quality, the materials they represent will be rejected.

All paint shall be supplied in strong, new, air-tight five gallon containers. All containers shall be cleaned of any paint spilled during filling operations. The containers shall be plainly marked with the name and address of the manufacturer, color of paint, number of gallons, date

of manufacture, lot or batch number, and such other pertinent information as will permit their ready identification. Containers shall be delivered in an unopened condition.

The material for all coating shall be furnished from one paint producer to insure comparability of each coat with the other coats.

INORGANIC ZINC SHOP COATING. The zinc coating materials shall be an inorganic coating formulated with powdered zinc filler to resist undercutting corrosion and to provide galvanic protection to the steel. The zinc coating shall have excellent resistance to solvents, water and brines.

The paint shall be such that when mixed in accordance with the manufacturer's instructions, a film of from 3 to 5 mils dry thickness can be obtained without film cracking, sagging, or loss of adhesion.

\* The pigment component shall consist primarily of finely divided zinc dust that meets ASTM D520 Type I. This metallic zinc shall be at least \_\_\_\_\_ percent by weight of the total solids of the dried coating. The vehicle shall be partially hydrolyzed ethyl silicate in appropriate alcohol solvents.

COMPOSITION. The mixed material shall conform to the following requirements.

Total Solids, (%) by wt.)	75 min.
Non Volatile of vehicle, (%) by wt.)	30 min.

Detailed Requirements

1. Weight per gallon	19.5 lbs. min.
2. Viscosity	70-90 KU
3. Pot Life	min. 6 hrs. at 25°C
4. Maximum Coarse Particle Size	9.5 microns
5. Drying Time @ 50% R.H.	
Set to touch	30 min.
Dry - Hard	2 hours

ALUMINUM EPOXY MASTIC TOUCH UP COATING. The aluminum epoxy mastic shall be Carbomastic 15 or approved equal.

The epoxy mastic shall be self-priming and contain rust inhibitors which effectively resists undercutting of the paint film. The epoxy mastic shall display compatibility with inorganic zinc primers, vinyl top coats, and coal tar epoxy coatings, it shall be aluminum in color and shall be a two-package material, and shall be well ground and not caked, skinned or badly settled in the container.

The epoxy mastic shall contain not less than 90 percent solids by weight. The mixed weight per gallon shall be 11.3 ± 0.5 pounds at 77°F.

\* Refer to accompanying letter.

The material shall have a minimum shelf life of 12 months and a minimum pot life of 1 hour at 75°F.

When applied by brushing or spraying, the material shall be capable of depositing a minimum dry film thickness of 6 mils without running or sagging.

VINYL FINISH COAT. The field finish coating of vinyl paint shall display compatibility with and adhesion to the cured inorganic zinc paint when applied in accordance with the manufacturer's printed instructions. The vinyl finish coating, single package, shall be Polyclad 956 or approved equal. The properties of the vinyl paint shall be such that it will result in a hard tough film within 4 hours after application at an ambient temperature of 70°F.

The vehicle shall consist essentially of vinyl chloride-vinyl acetate solvent polymerized copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

The vinyl paint shall contain no less than 25 % total solids by volume. Total weight per gallon at 77°F shall be 10.0 (+ 1.0) pounds.

The paint shall be well ground and shall not be caked, livered, skinned or badly settled in the container.

The color of the vinyl finish coat shall be Green, Federal Color No. 595-14272.

#### RESISTANCE TESTS FOR INORGANIC ZINC

FRESH WATER TEST. Panels shall be scribed down to the base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at 75°F ± 5°F. The panels shall show no rusting, blistering, or softening when examined after 30 days. The fresh tap water shall be replaced after each examination.

SALT WATER TEST. Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in an aqueous solution of 5 % sodium chloride at 75°F ± 5°F. The panels shall show no rusting, blistering, or softening upon examination of 7, 14 and 30 days. The sodium chloride solution shall be replaced with a fresh solution after each examination.

SALT FOG TEST. Panels shall be tested in accordance with ASTM B117. After 1000 hours continuous exposure, the coating shall show no adhesion loss, no softening, nor shall it exhibit any steel corrosion or blistering beyond 1/16 of an inch from the scribed line.

HEAT TREATMENT. Panels shall be heated to 500° F for one hour. They shall be immediately quenched in tap water at 70° F ± 5° F. Panels shall show no blistering or any delamination of the coating.

#### CONSTRUCTION REQUIREMENTS

SURFACE PREPARATION. Prior to application of the zinc coating in the shop, the top surface of the deck plate shall be cleaned in accordance with Steel Structure Painting Council SP-10-63 and all other structural steel surfaces to be coated shall be cleaned in accordance with Steel Structure Painting Council SP-6-63. The finished surface profile shall be between 1.0 mils and 2.0 mils. Areas to be welded in the field shall be masked or otherwise covered and shall not receive a zinc coating in the shop.

Hand cleaning, power tool cleaning, or other approved methods shall be used to remove rust, loose mill scale and slag prior to spot painting of damaged and welded areas in field. The Contractor is referred to Steel Structure Painting Council specifications SP-2-63 and SP-3-63.

Prior to applying any field coats, the Contractor shall insure that all foreign material such as oil, grease, dust and dirt are removed from all surfaces to be painted. The Contractor is referred to Steel Structure Painting Council specifications SP-1-63.

The Contractor shall provide access to any work location where cleaning and painting may be in progress for servicemen and inspectors of the manufacturer of the paint, as well as for representatives of the Department.

The Engineer shall give his approval of surfaces to be painted before any paint is applied.

APPLICATION. Where thinning of paint is required, only thinners compatible with the base material and recommended by the manufacturer shall be used and then only to the extent permitted. In the absence of specific requirements herein, the manufacturer's application instructions shall govern.

In general, no paint or paint ingredients shall be stored in the immediate vicinity of the bridge structure. The quantity of paint materials brought on the bridge shall be sufficient to supply the quantity required for the day's painting and proper precautions against fire shall be taken by the Contractor.

The inorganic zinc coating shall be mixed and applied in the shop in strict accordance with the Formulator's furnished written instructions. Minimum thickness of the dry zinc coating shall be 3 mils. The zinc coating shall be sprayed using the manufacturer's recommended spray equipment.

In general, brush application shall be limited to touch up operation. The touch up shall be applied in the field to field welded and damaged areas, after assembly is complete. The aluminum epoxy shall be applied in strict accordance with the manufacturer's recommendation. The minimum dry thickness of the aluminum epoxy coating shall be 5 mils.

One vinyl finish coat shall be applied to the remaining exposed structural steel surfaces in strict accordance with the manufacturer's recommendations. The vinyl coat shall be sprayed using airless spray equipment. The average thickness of wet vinyl coat shall be about 12 mils. The total dry thickness of the zinc shop coat and the vinyl finish coat shall be no less than 7 mils when checked by the Contractor in the presence of, and to the satisfaction of, the Engineer. The vinyl coat shall not be applied when air temperature is below 40°F and when the surface temperature is greater than 5°F above the dew point. The vinyl finish coat shall have a uniform appearance.



**Maryland Department of Transportation**

State Highway Administration

James J. O'Donnell  
Secretary

M. S. Caltrider  
Administrator

Please Reply to:  
State Highway Administration  
Division of Materials & Research  
2400 West Joppa Road  
Baltimore, Md. 21022

September 25, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Sir:

In reference to your request to Mr. Nathan L. Smith, Jr. for our specification on zinc-rich paints or primers (inorganic or organic types) the following specification is presently being used in the State of Maryland.

Paints shall be tested in accordance with Federal Test Method Standard 141.

Zinc rich primers shall be applied on shotblast cleaned steel for new structures or sandblast cleaned structures which are to be rehabilitated. It shall be self cure inorganic zinc alkyl silicate base or organic vehicle and meet the requirements of specification SSPC-PS 12.00.

Zinc rich primer for galvanized surfaces shall meet the requirements of Federal Specification TT-P-641, Type II, zinc dust-zinc oxide.

I hope this information is of assistance to you and if there are any further questions, please contact me.

Sincerely yours,

Donald J. Rohrback, Chief  
Bureau of Tests

RK/mlg

CC: Mr. N. L. Smith, Jr.

H - 149

My telephone number is (301) 321-3941

P.O. Box 717 / 300 West Freston Street, Baltimore, Maryland 21201



AD-A093 495

ARTECH CORP FALLS CHURCH VA

F/G 11/3

REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS, (U)

SEP 79 F ORDWAY, M J HAMMELL

N00600-76-D-0511

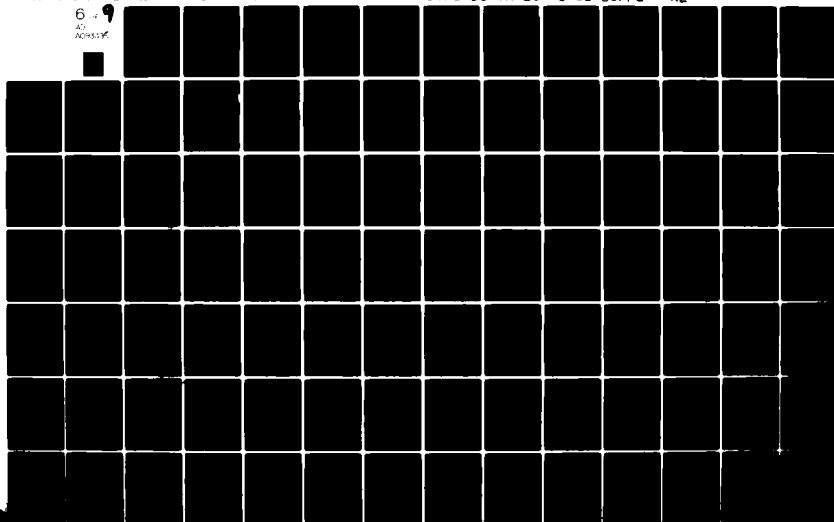
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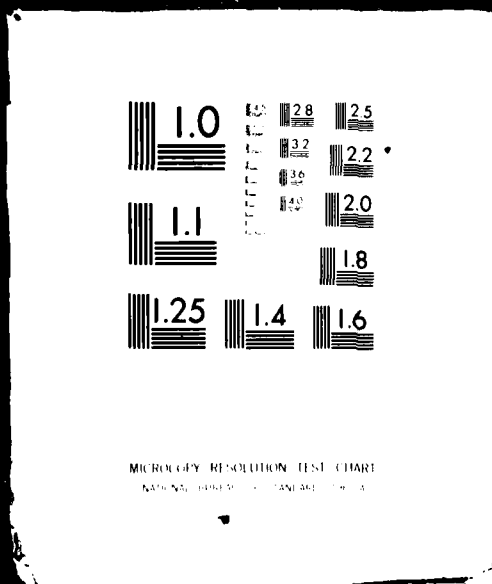


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STATE OF MICHIGAN



WILLIAM G. MILLIKEN, GOVERNOR  
DEPARTMENT OF TRANSPORTATION

TRANSPORTATION BUILDING, 425 WEST OTTAWA    PHONE 517-373-2090  
POST OFFICE BOX 30050, LANSING, MICHIGAN 48909

JOHN P. WOODFORD, DIRECTOR

October 8, 1979

Mr. Fred Ordway  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Sir:

In response to your letter of September 29, 1979, we are enclosing our current specification for the use of inorganic zinc rich paints. These specifications are still experimental and subject to change. It would appear, however, that any changes will be minor and for purposes of clarity, not intent.

We are in the process of establishing performance requirements in the laboratory tests. These tests will pertain not only to the products durability, but also to its ease of handling and application. Currently, we have approved the three listed products based upon their ease of application. The durability tests should be completed on all submitted products about mid-1980, at which time an updated product list will be made available.

If you have any questions or require further information, please contact Mr. Gary L. Tinklenberg at (517) 322-1222 of our Coatings, Sealers, and Plastics Laboratory.

Sincerely,

TESTING AND RESEARCH DIVISION

K. A. Allemeier  
Engineer of Testing and Research



H - 150

*An Equal Opportunity Employer*

SPECIAL PROVISION  
FOR  
CLEANING AND COATING OF STEEL STRUCTURES  
(2-Coat System)

DESCRIPTION

This work shall consist of the complete blast cleaning and coating of the metal surfaces of existing steel structures, including downspouts, sign brackets, utility conduits, (where called for in the proposal) and excluding hand railing and chain link enclosures.

The work shall be done in accordance with the 1976 Michigan Standard Specifications for Highway Construction except as otherwise provided in the proposal.

MATERIALS

The primer coating shall be one of the following inorganic zinc coatings:

Mobilzinc Uni-Pak 13-G-10W  
Carbo Zinc SP-76  
Dimetcote E-Z II

Supplier Information is listed at end of Special Provision.

The vinyl coating for the topcoat shall be manufactured by the supplier of the inorganic zinc primer. It shall consist of vinyl resins dissolved in suitable solvents with sufficient plasticizers included to insure that the coating will have adequate tensile strength. The coating shall be supplied in a single package. It shall be well ground and shall not be caked, livered, skinned, or badly settled in the container. The coating shall be capable of being applied at a 3.5 mil dry film thickness in one coat.

The color for the vinyl topcoat shall be Color Number 25184 (Blue) from Federal Standards No. 595a dated January 2, 1968.

CLEANING OF STRUCTURES:

The surfaces to be coated shall be blast cleaned to a "near white" finish which is defined as follows:

A finish from which all paint, oil grease, dirt, mill scale, rust, corrosion products, oxides, or any other foreign matter have been removed except for very slight shadows, very slight streaks, or slight discolorations; at least 95% of each square inch of the surface shall have the appearance of a surface blast cleaned to a white metal finish and the remainder shall be limited to the light discolorations mentioned above (for reference, see NACE No. 2 or SSPC-SP10-63).

Care must be taken to protect freshly coated surfaces, galvanized fence enclosures, and any adjacent concrete from blast cleaning. For structures with piers, a minimum of 5 feet on each side of the piers shall be blast cleaned on the same day and primed as a unit to prevent blasting damage to previously primed surfaces. Blast damaged primed surfaces shall be thoroughly wire brushed or if rust is visible reblasted to near-white and reprimed.

All fins, tears, or slivers that are present or appear during the blasting operation shall be removed by grinding and the area reblasted to give a good (2 mil) surface profile.

Scaling hammers are permissible to remove heavy scale, but heavier type chipping hammers that would excessively scar the metal shall not be used.

Abrasives used for blast cleaning shall be either clean dry sand, mineral grit, or manufactured grit meeting the following requirement:

The gradation of the abrasives shall be such that 100% shall pass the No. 12 sieve.

All sand and paint residue shall be removed from all the exposed steel surfaces before any coating is applied. The steel shall be blown with clean dry air followed by vacuuming with a good commercial grade vacuum cleaner equipped with a brush type cleaning tool. The vacuum cleaned steel shall be primed within 8 hours after blast cleaning. After the steel is primed, it shall be vacuumed again before topcoating. If for any reason this vacuuming does not remove all the accumulated dust and/or dirt, or if in the opinion of the Engineer the surface is unfit for topcoating, the surface shall be scrubbed with a mild detergent solution (any commercial laundry detergent) and thoroughly rinsed with water before the surface is topcoated.

#### COATING OF STRUCTURE:

After the entire surface to be coated has been cleaned and approved by the Engineer, the primer shall be applied so as to produce a uniform, even coating bonded with the metal. Succeeding coats shall also be so applied. All coating must be done in a neat and workmanlike manner as outlined in SSPC-PA 1-64.

Mixing the Coating - The coating shall be mixed with power equipment in accordance with the producer's directions to a smooth, lump free consistency. Mixing shall be done as far as possible in the original containers and shall be continued until all of the metallic powder or pigment is in suspension.

Prior to straining through a 50 mesh (max) screen to remove any foreign particles, care must be taken to insure that all of the coating solids that may have settled to the bottom of the can are thoroughly dispersed. After straining, the mixed material shall be kept under continuous agitation up to and during the time of application.

Thinning the Coating - The coating when thoroughly mixed is ready for use. If it is necessary in cool weather to thin the coating so that it can be properly applied it shall be done only in accordance with the producer's recommendations.

Application of the Coating - The coating shall be applied only when the air and steel temperatures are above 40°F. It shall not be applied when the relative humidity is greater than 95% or when a combination of temperature and humidity conditions are such that moisture is condensing upon the surface to be coated. If there is any doubt that the above conditions are being met, the following test shall be performed:

A small area is moistened with a damp cloth so as to apply a clearly defined, thin film of water. If this film evaporates within 15 minutes, the surface shall be considered safe to coat.

Coating shall not be permitted when surface temperatures are high enough to cause blistering.

A minimum of two days of proper drying conditions shall be required between the application of the primer and the topcoat.

**Coating Thickness** - The dry film thickness of the primer shall be not less than  $2\frac{1}{2}$  mils and of the topcoat not less than  $3\frac{1}{2}$  mils as determined by the Engineer using a magnetic film thickness gage. If running and/or sagging occurs when the coatings are spray applied in one coat, the coating shall be applied in multiple passes of the gun separated by several minutes. Where excessive primer thickness causes "mud-cracking", the coating material shall be scraped back to soundly bonded coating and the area re-coated to a minimum of  $2\frac{1}{2}$  mils.

The Engineer will inspect each section of steel before it is coated. The Contractor shall furnish and erect scaffolding to the satisfaction of the Engineer to facilitate a safe inspection of all cleaned areas and be afforded every opportunity to check the film thickness of each coat applied. If an area is approved for priming or topcoating, the Contractor then may coat the area.

Metal rollers or clamps and all other fastening devices for scaffolds and equipment attached to the structural steel which will mar or damage freshly coated surfaces will be prohibited. It will be required that rubber rollers or other protective devices, as approved by the Engineer, be used on scaffold fastenings for the purpose of protecting the freshly coated surfaces.

#### PROTECTION OF WORK:

Pedestrian and vehicular or other traffic upon or underneath the structures shall be protected as provided in Section 1.05.13 of the 1976 Standard Specifications for Highway Construction. All portions of the structures (superstructure, substructure, slope protection, and highway appurtenances) shall be protected against splatter, splashes and smirches of coating, or coating material by means of protective covering suitable for the purpose. Similar protection shall be afforded any highway appurtenances that could be damaged by blast cleaning operations. The Contractor shall be responsible for any damage caused by his operations to vehicles, persons, or property.

During blast cleaning operations, provisions must be made by the Contractor to protect existing traffic from any hazards resulting from the blast cleaning operations. These provisions shall include a type of barrier system which would protect against direct blasting of vehicles or pedestrians, eliminate abrasive materials and debris from falling on the traveled portions of the pavement, and prevent the spreading of abrasive materials and debris in the area which would create a traffic hazard. At the pre-construction meeting, the Contractor must submit a plan detailing the method of protection to be used.

Whenever the intended purposes of the protective devices are not accomplished, work shall be suspended until corrections are made. In addition, any abrasive material and debris deposited on the pavement, shoulders, or slope paving in the working area must be removed before those areas are reopened to traffic.

Employees performing the blast cleaning operations shall be provided with a air-supplied sand blasting hood approved by the U. S. Bureau of Mines. The air supply system shall include, but not be limited to the following approved safety features: Air line filter, pressure reducing valve with gauge, and pressure release valve. Air supply to the employee shall not be contaminated with harmful materials or elements.

The Contractor shall carry the minimum insurance as specified in Article 1.07.08, Damage Liability and Insurance, of the 1976 Standard Specifications for Highway Construction.

#### METHOD OF MEASUREMENT:

"Cleaning of Steel Structures" will be measured as a unit, for each structure.

"Coating of Steel Structures" will be measured as a unit, for each structure.

"Cleaning and Coating Utility Conduits" will be measured as a unit, for each structure.

The type of structure, span, width of roadway, and tons of steel may be shown on the plans or in the proposal as information for the bidder. The estimate of materials and labor for each structure is entirely the responsibility of the bidder.

#### BASIS OF PAYMENT:

"Cleaning of Steel Structures" will be paid for at the contract lump sum price, which price shall be payment in full for furnishing all the labor, materials, and equipment to blast clean the structural steel and provide all the necessary health and safety equipment as specified herein.

"Coating of Steel Structures" will be paid for at the contract lump sum price, which price shall be payment in full for furnishing all the labor, materials, and equipment to coat the structural steel and provide all the necessary health and safety equipment as specified herein.

Mobil Zinc      Uni-Pak 13-G-10W

Produced by: Mobil Chemical Company  
Maintenance and Marine Coating Department  
901 North Greenwood Avenue  
Kankakee, Illinois 60901      815-933-5561

Represented      Ron Mizerek  
in Michigan      Toledo, Ohio  
by:      419-475-5369

Carbo Zinc      SP-76

Produced by: Carboline  
350 Hanely Industrial Ct.  
St. Louis, Mo. 63144

Represented      P.C.A., Inc.  
in Michigan      3221 W. Big Beaver Rd.  
by:      Suite 106  
Troy, Michigan 48084      313-649-2214

Dimetcote      EZ-11

Produced by: Ameron Protective Coating Division  
Brea, California 92621

Represented      Bob Marshall  
in Michigan      1554 Hawthorne  
by:      Grosse Pointe Woods, Michigan      313-886-5555





Minnesota Department of Transportation

Transportation Building,

St. Paul, MN 55155

Phone 612-296-3164

September 26, 1979

Mr. Fred Ordway  
Executive Vice President  
ARTECH CORP.  
2901 Telestar Court  
Falls Church, Virginia 22042

4 OCT 1979

In reply refer to:  
350

Dear Mr. Ordway,

Enclosed is a copy of Mn/DOT Specification 3503 Bridge Paint, Zinc-Rich, Organic Vehicle Primer, Specification 3505 Bridge Paint, Vinyl Wash Primer, Specification 3523 Bridge Paint, Aluminum Finish Coat, Chlorinated Rubber Vehicle Type and Specification 3529 Bridge Paint, White Tint Base, Vinyl Finish Coat which you requested September 19th.

Sincerely,

B. F. Himmelman, P.E.  
Materials Engineer  
Materials Engineering Section

3501

The manufacturer shall allow adequate time for testing the paint and raw materials.

**B General Testing**

All tests shall be conducted in accordance with the latest appropriate ASTM test methods except as otherwise stated herein.

Weight per gallon and viscosity of all paints and varnishes shall be determined at 77° F.

**C Specific Tests**

**C1 Water Resistance**

A film shall be flowed out on a clean tin plate and dried for 72 hours and immersed in distilled water for 24 hours at room temperature, following which it shall be immediately immersed for 5 hours in distilled water at 200 to 210° F. One hour recovery period at room temperature shall be allowed before judging.

**C2 Alkali Resistance**

A test tube 6 inches by 1 inch shall be dipped in the varnish and allowed to drain with rounded end uppermost, and dried for 72 hours. The rounded end shall be immersed 2 inches below the surface of a 3 percent solution of sodium hydroxide in distilled water for 7 hours at a temperature of 68 to 70° F.

**3503**

**Bridge Paint, Zinc-Rich, Organic  
Vehicle Primer**

**3503.1 SCOPE**

This Specification covers a one-package phenoxy binder primer for structural steel. Due to the high flammability and possible toxic hazards, this paint is not intended for use in confined areas such as tanks unless proper precautions are followed. This coating is intended for application by brushing or spraying, either airless or conventional. Due to rapid drying characteristics, best surface appearance is obtained by spraying.

**3503.2 REQUIREMENTS**

**A Basic Requirements**

The primer shall be easy to apply, adhere tenaciously to a properly prepared surface, and be suitable for the purpose intended in all respects. The paint shall meet the requirements of the listed specifications and the applicable requirements of 3501.

The paint shall be homogeneous, free of contaminants, and be of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements

3503

of the paint. The dispersion shall be of a nature that the pigment does not settle readily, does not cake or thicken in the container and does not become granular or curdled. Any settlement of pigment in the paint shall be limited to a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, and other qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing. The paint shall be inspected on the job. Any paint which shows settling beyond that described herein will be rejected.

**B Composition of Paint**

Total pigment, minimum ..... 62.5%

Total vehicle, maximum ..... 37.5%

**C Composition of Pigment**

Type I Type II  
Red Tint Gray

Zinc Dust (TT-P-460, Type I, except the metal zinc content shall be 95% by weight minimum), minimum ..... 95.0%

Red Iron Oxide, maximum (Note 1) .... 1.5%

Zinc Oxide, TT-P-463, Type I, Grade A or B ..... 1.5%

Thixotropes and Additives, maximum ..... 3.5%

Note 1—Fe<sub>2</sub>O<sub>3</sub> 93.5% minimum; oil absorption, 21; fineness through 325 mesh screen, 99% minimum; and specific gravity, 5.15.

The average particle size of the pigment shall not exceed 9 microns as determined by the Fisher Sub-Sieve Sizer. The red iron oxide must first be ground into a portion of the vehicle to provide a Hegman grind sufficient to produce a pronounced color in the Type I. The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

**D Composition of Vehicle**

Polyaryl Ether (Note 2) ..... 19.0%  
Ethylene Glycol Monoethyl Ether Acetate, Mil E-7125 .. 66.8%  
Toluene, TT-T-348 ..... 14.2%

Note 2—The Polyaryl Ether shall be a polyhydroxy poly-alkaryl polyether having the following properties:

Specific Gravity .....	1.18
Viscosity of 40% solids in methyl ethyl ketone. Brookfield RVF, 20 rpm No. 5 spindle 4,500 to 7,000 cps	
Reduced viscosity (0.2 g/100 ml. dimethylformamide) .....	0.4 to 0.6
Ultimate tensile strength .....	9,000 to 9,500 psi
Ultimate tensile elongation .....	50 to 100%
Softening temperature .....	212°F.
Bulking value .....	9.83 lbs. per gal.

When dried upon a potassium bromide disc, a film of the primer shall have infrared absorption maximums at the same wave lengths and to the same relative degree as that shown by the curve on file at the Laboratory.

#### E Characteristics of Paint

Volatiles at 221°F. by weight .....	28%–32%
Weight per gallon, pounds at 77°F .....	17.2–18.0
Viscosity, Krebs Units at 77°F .....	100–120
Metallic zinc, percent by weight of extracted pigment. Federal Test Method No. 141, Method 7221 .....	90.2% min.
Drying time at 77°F, 50% Relative Humidity, 6 mil wet thickness Set to touch, maximum .....	45 minutes
Hard dry, maximum .....	5 hours
Storage life, minimum .....	1 year

#### F Properties of Cured Coating

When applied to a plate glass panel with a 6 mil gap clearance doctor blade and cured for 15 days at 77° plus or minus 5°F and 50 plus or minus 5% relative humidity, the coating shall have a minimum Pencil Hardness of B.

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on sandblasted steel having an anchor profile pattern of one to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specifications QQ-S-636, the panel being previously cleaned by sand blasting to produce a one to 1.5 mil anchor pattern, and cured for 15 days at a relative humidity of 50 plus or minus 5% and tested according to the Critical Mandril Test, Federal Test Method Standard No. 141, Method 6222.

there shall be no loosening of the film above the point of the longest continuous crack.

When a steel panel is sandblasted to white metal and coated with 3 to 4 mils dry film thickness of this coating and cured for 15 days at 75° plus or minus 2°F and 50 plus or minus 5% relative humidity and diagonally scribed to expose bare steel, there shall be no underfilm corrosion on the surface of the panel extending beyond the scribed lines after 1,000 hours when tested according to ASTM B-117.

#### G Labeling

In addition to the requirements of 3501, the labeling shall show the precautions to be taken in the handling and application of the paint, and complete instructions for use shall be included with each container of paint.

#### 3503.3 INSPECTION, SAMPLING, AND TESTING

##### A Inspection and Sampling ..... 3501.5A

##### B Testing

Testing shall be performed according to the latest ASTM Test Methods, Federal Specification 141, or methods designated by the Department.

## 3505

### Bridge Paint, Vinyl Wash Primer

#### 3505.1 SCOPE

This Specification covers a wash primer formulated specifically for application prior to painting clean aluminum, galvanized surfaces, or surfaces previously coated with an organic or inorganic zinc-rich primer. It is also used on blast cleaned steel when specified and is mandatory as an undercoat on vinyl paint systems.

#### 3505.2 REQUIREMENTS

##### A Basic Requirements

The paint shall be satisfactory in all respects as a tie coat over organic/zinc-rich primers. The paint shall meet the requirements of the listed specifications and the applicable requirements of 3501.

Pounds per  
80 gallons  
of Resin

##### B Composition of Resin Component

Component	56
Polyvinyl-butylal resin (Note 1) .....	56
Zinc Chromate, insoluble type (Note 2) .....	54
Magnesium-silicate (Type A or B, MIL-M-15173) .....	8

Lampblack (TT-P-350) ..... 0.6

Butyl Alcohol, normal (TT-B-846) ..... 125

Ethyl Alcohol, Grade III of O-E-760 (Note 3) ..... 360

Note 1—The polyvinyl partial butyl resin shall contain only polyvinyl butyl, polyvinyl alcohol, and polyvinyl acetate in the molecule, and shall have the following Properties:

Polyvinyl alcohol, per cent by weight ..... 19.0-22.0

Polyvinyl acetate, per cent by weight ..... 1.0 maximum

Specific Gravity ..... 1.10-1.14

Inherent viscosity, ASTM D 1243 ..... 0.87-0.95

Heating loss, 45 minutes at 105°C., per cent by weight ..... 3.0 maximum

Ash, per cent by weight ..... 0.1 maximum

Note 2—The zinc chromate shall be of an insoluble type, showing an analysis of 16 to 19 per cent CrO<sub>3</sub> and 67 to 72 per cent ZnO, and not more than one per cent water soluble salts

Note 3—Isopropyl alcohol (99 per cent) may be substituted in part for ethyl alcohol on an equal volume basis. The isopropyl alcohol shall have a specific gravity of 0.785 to 0.790 and a distillation range not greater than 1.5°C., and this range shall include 82.3°C.

Pounds per  
20 gallons of  
Acid Component

C Composition of Acid Component

Phosphoric Acid, 85% (Class I of O-O-670) ..... 28

Water ..... 25 maximum

Ethyl Alcohol Grade III of O-E-760 (Note 3) ..... 102

Note 3—Isopropyl alcohol (99 per cent) may be substituted in part for ethyl alcohol on an equal volume basis. The isopropyl alcohol shall have a specific gravity of 0.785 to 0.790 and a distillation range not greater than 1.5°C., and this range shall include 82.3°C.

D Characteristics of Resin Component

Minimum Maximum

Pigment, per cent by weight ..... 9.5 10.5

Volatiles, per cent by weight ..... 80.0 82.0

Non-volatile vehicle, per cent by weight (calculated by difference) ..... 8.5 9.5

Ratio of pigment to nonvolatile vehicle, by weight ..... 9.7 to 9 10.3 to 9

Coarse particles of skins, as residue retained on standard No. 325 mesh sieve (RR-S-366), per cent by weight ..... 0.5

Viscosity, Krebs Units ..... 57 67

Weight per gallon, pounds ..... 7.2 7.7

Fineness of grind ..... 5

Chromium oxide (CrO<sub>3</sub>), per cent by weight of pigment ..... 14

Zinc Oxide (ZnO), per cent by weight of pigment ..... 57

Distillation:

Initial boiling point, °C. .... 75 82

Temperature at 80 ml. point, °C. .... 85

Temperature at 100 ml. point, °C. .... 116

End point, Temperature, °C. .... 120

Volume at end point, ml. .... 112

Settlement:

The resin component as received shall show no more severe settling than a soft mushy mass that can be readily reincorporated into the paint. Any hard or dry settling will result in rejection of the paint.

E Characteristics of Acid Component

Minimum Maximum

Phosphoric acid, per cent by weight .... 15.0 16.5

Distillation:

Initial boiling point, °C. .... 75 81

Temperature at 105 ml. point, °C. .... 82

Volume at end point, ml. .... 120

Maximum temperature during distillation, °C. .... 102

Weight per gallon, pounds ..... 7.5 7.9

F Characteristics of mixed Resin and Acid Components

Dry time, hard, minutes ..... 30 maximum

Smooth homogeneous mix, no gelation within 24 hours in closed container.

G Packaging and Labeling

The label of the containers shall show the State Specification number, the manufacturer's name, lot or batch number, date

**3505**

of manufacture, and date (if any) beyond which the paint must not be used without additional testing and approval.

The label shall state that the primer is to be packaged such that the acid component can be mixed with the resin component in the resin component container. The resin and acid components shall be separately packaged and the packages shall be of such type as to prevent attack by the components.

The label shall also state that one part by volume of the acid component is to be added slowly with constant stirring to four parts by volume of the resin component just before use and that the mixed components must be used within 8 hours. It shall further state that the mixed material is intended for spray application in dry film thickness of 0.3 to 0.5 mil.

**3505.3 INSPECTION, SAMPLING, AND TESTING**

**A** Inspection and Sampling ..... 3501.5A

**B** Testing

Testing shall be performed according to the latest ASTM Test Methods, Federal Test Method No. 141, or methods designated by the Department.

**3506****Prime Coat, Red Lead-Iron Oxide****3506.1 SCORE**

This Specification covers a corrosion inhibiting paint to be used as a primer coat and a field spot coat on metals.

**3506.2 REQUIREMENTS**

**A** Basic Requirements ..... 3501

**B** Composition of Paint

Total Pigment (Minimum) ..... 73%

Total Vehicle (Maximum) ..... 27%

**C** Composition of Pigment

Red Lead, 97% (Minimum) ..... 80%

Red Iron Oxide (85%  $\text{Fe}_2\text{O}_3$ ) ..... 17-19.7%

Gelant, bentone 38 or equivalent (Maximum) . 0.5%

**D** Composition of Vehicle

Raw Linseed Oil (Minimum) ..... 95%

Thinners and Driers (Maximum) ..... 5%

**E** Weight Per Gallon (Minimum) ..... 22.0 lbs.

**F** Drying Time (Maximum) ..... 18.0 hrs.

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Lampblack (TT-P-350) ..... 0.6

Butyl Alcohol, normal (TT-B-446) ..... 125

Ethyl Alcohol, Grade III of O-E-760 (Note 3) ..... 360

Note 1—The polyvinyl partial butyral resin shall contain only polyvinyl butyral, polyvinyl alcohol, and polyvinyl acetate in the molecule, and shall have the following Properties:

Polyvinyl alcohol, per cent by weight ..... 19.0-22.0

Polyvinyl acetate, per cent by weight ..... 1.0 maximum

Specific Gravity ..... 1.10-1.14

Inherent viscosity, ASTM D 1243 ..... 0.87-0.95

Heating loss, 45 minutes at 105°C., per cent by weight ..... 3.0 maximum

Ash, per cent by weight ..... 0.1 maximum

Note 2—The zinc chromate shall be of an insoluble type, showing an analysis of 16 to 19 per cent  $\text{CrO}_3$  and 67 to 72 per cent  $\text{ZnO}$ , and not more than one per cent water soluble salts.

Note 3—Isopropyl alcohol (99 per cent) may be substituted in part for ethyl alcohol on an equal volume basis. The isopropyl alcohol shall have a specific gravity of 0.785 to 0.790 and a distillation range not greater than 1.5°C., and this range shall include 82.3°C.

Pounds per  
20 gallons of  
Acid Component

C Composition of Acid Component  
Phosphoric Acid, 85% (Class I of O-O-670) ..... 28

Water ..... 25 maximum

Ethyl Alcohol Grade III of O-E-760 (Note 3) ..... 102

Note 3—Isopropyl alcohol (99 per cent) may be substituted in part for ethyl alcohol on an equal volume basis. The isopropyl alcohol shall have a specific gravity of 0.785 to 0.790 and a distillation range not greater than 1.5°C., and this range shall include 82.3°C.

D Characteristics of Resin Component  
Minimum Maximum

Pigment, per cent by weight ..... 9.5 10.5

Volatiles, per cent by weight ..... 80.0 82.0

Nonsoluble vehicle, per cent by weight  
(calculated by difference) ..... 8 9.5

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Ratio of pigment to nonvolatile vehicle,  
by weight ..... 9.7 to 9 10.3 to 9

Coarse particles of skins, as residue re-  
tained on standard No. 325 mesh sieve  
(RR-S-366), per cent by weight ..... 0.5

Viscosity, Krebs Units ..... 57 67

Weight per gallon, pounds ..... 7.2 7.7

Fineness of grind ..... 5

Chromium oxide ( $\text{CrO}_3$ ), per cent by  
weight of pigment ..... 14Zinc Oxide ( $\text{ZnO}$ ), per cent by weight of  
pigment ..... 57

Distillation:

Initial boiling point, °C. .... 75 82

Temperature at 80 ml. point, °C. .... 85

Temperature at 100 ml. point, °C. .... 116

End point, Temperature, °C. .... 120

Volume at end point, ml. .... 112

Settlement:

The resin component as received shall show no more severe  
settling than a soft mushy mass that can be readily re-in-  
corporated into the paint. Any hard or dry settling will  
result in rejection of the paint.

E Characteristics of Acid Component  
Minimum Maximum

Phosphoric acid, per cent by weight .... 15.0 16.5

Distillation:

Initial boiling point, °C. .... 75 81

Temperature at 105 ml. point, °C. .... 82

Volume at end point, ml. .... 120

Maximum temperature during  
distillation, °C. .... 102

Weight per gallon, pounds ..... 7.5 7.9

F Characteristics of mixed Resin and Acid Components  
Dry time, hard, minutes ..... 30 maximum  
Smooth homogeneous mix, no gelation within 24 hours in closed  
container.

G Packaging and Labeling  
The label of the containers shall show the State Specification  
number, the manufacturer's name, lot or batch number, date

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C

**Composition of Pigment**

Basic Lead Silico Chromate .....	94.5%
Iron Oxide, Red (Class I) .....	5.5%
Gellant Phentone 3H or equivalent .....	1.5%
Lampblack .....	1.5%

D

**Composition of Vehicle**

Alkyd Resin Solid (TT-R-266 Type A, Class A or B) .....	52.5%
Thinner .....	45.5%
Cobalt Drier (12% Metal) or equivalent .....	0.18%
Zincum Drier (12% Metal) or equivalent .....	0.66%
Calcium Drier (12% Metal) or equivalent .....	0.87%
Anti-Skinning Agent .....	0.29%
Weight per Gallon (Minimum) .....	9.8 pounds
Drying Time (Maximum) .....	7 hours
Viscosity (Krebs Units) .....	80-85
Color shall match Mn/DOT color standard.	

3522.3

**INSPECTION, SAMPLING AND****TESTING**

3501.5

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3523

**Bridge Paint, Aluminum Finish Coat,  
Chlorinated Rubber Vehicle Type**

3523.1

**SCOPE**

This Specification covers plasticized chlorinated rubber resin vehicle base aluminum paint suitable for use as a finish coat on steel structures. Type I is a rapid drying type for spray application only in unconfined spaces. Type II is a slower drying type for brush application in confined or unconfined spaces.

Both types I and II paint may be applied directly over the following previously applied systems.

- (1) Red Lead Primers
- (2) Basic Lead Silico Chromate Primer
- (3) Phenolic, Alkyd, and Vinyl Finish Coats
- (4) Organic Zinc Primer, Phenoxy Vehicle Type, with an intermediate coat of vinyl wash primer
- (5) Inorganic Zinc Primers, with an intermediate coat of vinyl wash primer.

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**3523.2 REQUIREMENTS****A Basic Requirements**

The raw materials and finished paint shall meet the requirements of the listed specifications and all applicable requirements of 3501. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.

The vehicle component shall be homogeneous, free of contaminants, and of a consistency suitable for use in the capacity for which it is specified. The vehicle shall possess satisfactory properties in all respects affecting application and curing. The thinner portion of the vehicle specified shall, in addition to complying with the specification requirements, comply with all air pollution regulations in effect at the time the paint is used.

**B Manufacturing and Packaging**

The paint shall be furnished in two-compartment containers meeting Interstate Commerce shipping standards, one for the vehicle and one for the aluminum powder. The total capacity of the two-compartment containers shall not exceed six gallons. The container for the vehicle shall be lined if necessary to prevent attack by the vehicle. The lining shall be such that it will not come off the inside of the container as skins.

All containers of the vehicle and aluminum powder shall be labeled to show name of contents, specification number, manufacturer's name, date of manufacture, and the manufacturer's batch number, together with instructions for mixing and use. Type I paint shall be labeled: "For Spray Application Only." Type II paint shall be labeled: "For Brush Application Only." Label instructions shall also state that the vehicle and aluminum powder shall be thoroughly mixed the day the paint is to be used.

**C Pigment Component Requirements**

The aluminum powder shall conform to the requirements of Federal Specification 11-P-320c, (Standard Lining), Type I, Class 2, (leafing), and shall be separately packaged in multiples of one pound of powder per gallon of vehicle.

**D Vehicle Component Requirements****DI Composition of Vehicle**

Pounds per 100 Gallons	
Type I	Type II
Chlorinated Rubber (Note 1) .....	221
Chlorinated Paraffin MII C-429, Type I) .....	247
Normal Butyl Acetate (TT-B-838) .....	106
Toluene (TT-I-548) .....	434
Epoxy Resin (Note 2) .....	95.7
	6.4

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Soya Lecithin .....	3.0	.....
Mineral Spirits (TT-T-291, Type II, Grade A) .....		254
Ethylene Glycol Monoethyl Ether Acetate (Mil E-7125) .....		254
Epichlorohydrin .....	1.0	1.0

**Note 1—Chlorinated Rubber Properties:**

Chlorine, percent .....	65-68
Viscosity, 20% in Toluene, Centipoises at 25° C .....	9-14
Specific Gravity .....	1.555 to 1.565
Index of Refraction .....	1.550 to 1.560

A 25% concentration in toluene shall show no haziness or turbidity, and when stored for one week at 77° F., it shall not corrode the tin plate in a covered tin-coated can.

**Note 2—Epoxy Resin Properties:**

Liquid, color 5 max. (Gardner), viscosity 100 to 160 poises at 25° C., epoxide equivalent 180-200.

**D2 Characteristics of Vehicle**

	Type I	Type II
Volatiles, percent, by weight of paint ..	61.5-64.1	58.5-60.7
Weight per gallon, pounds .....	8.3-8.7	8.5-8.9
Viscosity, Gardner-Holdt .....	A-C	J-L
Toluene, by volume of volatiles, % max.	19	5.0

**Drying Time:**

Set to touch, hours at 77° F. ....	2 max.	2 max.
Dry through, hours at 77° F. ....	4 max.	4 max.

**3523.3 INSPECTION, SAMPLING, AND TESTING**

**A** Inspection and Sampling ..... 3501.5A

**B Testing**

Testing shall be performed according to the latest ASTM Test Methods, Federal Test Method No. 141, or methods designated by the Department.



3529

3529

### Bridge Paint, White Tint Base, Vinyl Finish Coat

#### 3529.1 SCOPE

This Specification covers a ready-mixed white tint base vinyl finish coat paint for use on carefully blast cleaned structural steel surfaces which have been primed with zinc-rich, organic vehicle type primer and pre-treated with vinyl wash primer. This paint is formulated for spray application.

#### 3529.2 REQUIREMENTS

##### A Basic Requirements

The paint shall be easy to apply and shall be satisfactory in all respects as the finish coat in the above mentioned zinc-rich paint system. The raw materials and finished paint shall meet the requirements of the listed specifications and all applicable requirements of 3501.

##### B Composition of Paint

	Pounds per 100 Gallons	
	Type I	Type II
Titanium Dioxide (TT-P-442, Type III or IV) .....	72.7	72.7
Vinyl Resin (Note 1, 1a) .....	87.2	84.8
Vinyl Resin (Note 2, 2a) .....	28.8	29.6
Toluene (TT-T-548) .....	109	76.9
Normal Butyl Acetate (TT-B-838) ..	495	.....
Di-(2-ethylhexyl) Phthalate .....	28.8	28.8
Soya Lecithin .....	7.2	7.2
Epoxy Resin (Note 3) .....	0.6	0.6
Methyl Normal Butyl Ketone .....	.....	490

The paint shall be limited to meet the color standards furnished by the Department's Laboratory. In tinting the paint, not over 30 percent by weight of the titanium dioxide may be replaced by an equal weight of the light fast tinting pigments.

Note 1—A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.39, containing 91 percent vinyl chloride, 1 percent vinyl acetate and 6 percent vinyl alcohol, with an intrinsic viscosity of 0.57 poise at 20°C in cyclohexanone.

Note 2—A vinyl chloride-vinyl acetate copolymer resin, specific gravity 1.35, containing 86 percent vinyl chloride, 13 percent vinyl acetate and 1 percent interpolymerized

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dicarboxylic acid (0.7 to 0.8 carboxyl), with an intrinsic viscosity of 0.53 poise at 20°C in cyclohexanone.

Note 1a—A vinyl chloride-vinyl acetate copolymer resin; specific gravity of 1.36; containing approximately 84 percent vinyl chloride and approximately 16 percent vinyl acetate; and with inherent viscosity (ASTM D 1243) of 0.49 to 0.51.

Note 2a—A vinyl chloride-maleate diester-unsaturated carboxylic acid terpolymer, with specific gravity of 1.31, and inherent viscosity (ASTM D 1243) of 0.31 to 0.32.

Note 1b—A partially hydrolized vinyl chloride-vinyl acetate copolymer resin; specific gravity of 1.36; and inherent viscosity (ASTM D 1243) of 0.54.

Note 2b—A carboxyl modified vinyl chloride-vinyl acetate copolymer resin; specific gravity of 1.33; and inherent viscosity (ASTM D 1243) of 0.54.

Note 3—Liquid, color 5 max. (Gardner), 100 to 160 poise viscosity at 25°C, 180 to 195 epoxide equivalent.

##### Vinyl Resin Options:

If vinyl resin 1 is used, vinyl resin 2 must be used.

If vinyl resin 1a is used, vinyl resin 2a must be used.

If vinyl resin 1b is used, vinyl resin 2b must be used.

Types 1 or 1) paint may be furnished at the option of the Contractor.

##### C Requirements of Finished Paint

	Type I	Type II
Toluene and Isoketones, by volume of volatiles, percent, maximum .....	19.0	19.0
Weight per gallon, pounds .....	8.1-8.5	7.7-8.1
Pigment, by weight of paint, percent ..	8.0-9.7	8.4-10.1
Volatiles, by weight of paint, percent ..	71.8-73.8	70.7-72.7
Viscosity, Krebs Units, maximum .....	61	61
Fineness of grind, Hegman, minimum ..	6	6
Drying time, set to touch, hours, minimum .....	1/2	1/2

The preparation of this paint in steel ball mills is not acceptable.

3529.3 INSPECTION, SAMPLING, AND

TESTING ..... 3501.5

# MISSISSIPPI STATE HIGHWAY DEPARTMENT

P. O. Box 1850 Jackson, Mississippi 39205

September 25, 1979

Re: V. To

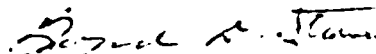
4:00 P.M.

Mr. Fred Ordway  
Executive Vice President  
ARTECH CORPORATION  
2901 Telestar Court  
Falls Church, VA 22042

Dear Mr. Ordway:

We are in receipt of your letter of September 19, 1979, regarding zinc-rich paints or primers. This is to advise you that currently the Mississippi State Highway Department is not using any zinc-rich paint system. Only trial or test sections of this paint have been placed, and it was formulated along the supplier's specifications.

Yours very truly,

  
Buford D. Stroud  
Testing Engineer

BDS:lm

CC: Lab File

AY B. DILLINGHAM, *Chairman*  
Rm. 926, Livestock Exchange Bldg.  
1600 Genesee  
Kansas City 64102

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755 N. Jefferson  
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MISSOURI  
STATE HIGHWAY COMMISSION



ROBERT N. HUNTER, *Chief Engineer*

BRUCE A. RING, *Chief Counsel*

L. V. McLAUGHLIN, *Asst. Chief Engineer*

MRS. IRENE WOLLENBERG, *Secretary*

P. O. Box 270  
Jefferson City, Missouri 65102  
Telephone (314) 751-2551

September 26, 1979

MATERIALS AND RESEARCH  
Specifications  
Inorganic Zinc Paint

4 00 PM

Mr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

As requested by your letter of September 19, 1979, we are attaching a copy of Section 1045 from our Standard Specifications and a copy of the supplements to those specifications.

Our specifications allow the use of inorganic zinc paint, however, we have never specified organic zinc paint.

Very truly yours,

A handwritten signature in cursive script, appearing to read "W. L. Trimm".

W. L. Trimm  
Division Engineer  
Materials and Research

## SECTION 1045

### PAINT FOR STRUCTURAL STEEL AND WOOD

#### 1045.1 Paint and Paint Materials.

**1045.1.1 General.** All paints, except two-component aluminum and inorganic zinc, shall be ready-mixed at the factory to comply with the specification formula for the type of paint ordered, shall be well ground to a uniform consistency and smooth texture, shall be free from dirt, water, and other foreign matter; shall be of such consistency that they will have good application, covering, and leveling properties, and shall dry within the specified period to a good film without running, streaking, or sagging. When it is specified that the paint shall be tinted, the tinting material shall be thoroughly and uniformly incorporated within the body of the paint to form a shade which shall match that of a sample submitted for the purpose. Any paint which has lvered or in any way hardened or thickened in the container, or in which the pigment has settled out so that it cannot be readily broken up with a paddle to a smooth uniform paint of good application consistency, will be rejected. The grinding equipment used in the manufacture of the paint shall meet the approval of the engineer. In no case will the use of a colloid mill, steel ball mill, or high speed mill be permitted.

**1045.1.1.1** All percentages and proportions are on a weight basis unless otherwise stated.

**1045.1.2 Sampling.** Each batch or lot of pigment and vehicle constituents for mixed paints shall be sampled and approved prior to being incorporated into a paint mixture unless otherwise directed by the Division Engineer, Materials and Research. Each batch or lot of vinyl paints and all mixed paints after manufacture shall be sampled and approved prior to use. Each batch or lot of each component of two-component aluminum and inorganic zinc paints shall be sampled and approved prior to use.

**1045.1.3 Packaging.** All containers shall be approved by the engineer as to type and weight and shall be free of physical defects. All containers shall be cleaned of any paint spilled during filling operations.

**1045.1.3.1** Except when supplied in containers of less than 5 gallons, all mixed paint shall be packaged in strong substantial 24 gage or heavier, new metal containers having lug-type replaceable tops. They shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture, and net weight of contents. The lot number and date of manufacture shall be stamped, stenciled, or painted directly onto the container using a weatherproof, durable material. In addition, labels on vinyl paints shall include complete instructions for their use.

**1045.1.3.2** Two-component aluminum paint shall be packaged in two-compartment metal containers or in two separate metal containers. The components shall be packaged in such proportions that the paste mixed with the vehicle, in the vehicle container, will yield one or 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture and net weight of contents. The lot number and date of manufacture shall be stamped, stenciled, or painted directly onto the container using a weatherproof, durable material.

1045.1.3.3 Two-component inorganic zinc shall be packaged in two-compartment containers or in two separate containers. The components shall be packaged in such proportions that the pigment, mixed with the vehicle, will yield one or 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint, the lot number, date of manufacture, shelf life, and individual net weights of pigment and vehicle. The lot number and date of manufacture shall be stamped, stenciled, or painted directly onto the container using a weatherproof, durable material. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

1045.1.4 Determination of Quantities. Quantities of paint shall be determined by volume. One gallon shall equal 231 cubic inches at 77 F. One gallon of mixed two-component aluminum paint shall consist of 2.404 pounds of aluminum paste and 0.804 gallon of varnish.

#### 1045.2 Pigment Constituents.

1045.2.1 Magnesium Silicate. This pigment shall consist substantially of natural hydrous magnesium silicate that is white, fibrous, and finely ground.

1045.2.2 Red Lead. This pigment shall consist of oxides of lead and shall meet the following requirements:

	Percent
True Red Lead ( $Pb_3O_4$ ), min	97.0
Total impurities, including moisture, water soluble matter, and matter insoluble in a mixture of nitric acid and hydrogen peroxide, max	1.0
Lead Monoxide ( $PbO$ )	Remainder
Coarse particles retained on No. 325 sieve, max	1.0

1045.2.3 Silica. This pigment shall be of the amorphous variety, shall be finely ground and free from grit and adulterants, and shall contain not less than 98.0 percent  $SiO_2$ .

1045.2.4 Montmorillonite. This pigment shall be a finely divided hydrous aluminum silicate powder suitable for use in paints.

1045.2.5 Red Oxide. This pigment shall be finely levigated natural red oxide or iron pigment, and shall contain not less than 85 percent oxide of iron ( $Fe_2O_3$ ). It shall contain not more than 0.5 percent moisture nor more than 0.6 percent sulfuric anhydride.

1045.2.6 Pure Red Iron Oxide. This pigment shall comply with the requirements of ASTM D 84-51(1974), Class I.

1045.2.7 Graphite. This pigment shall be natural amorphous material containing not less than 65 percent graphite carbon. Of material other than carbon, not more than 2 percent shall be other than silica, iron oxide, and alumina. Graphite shall be finely ground so that not less than 98 percent passes a No. 325 sieve.

1045.2.8 Aluminum Stearate. This pigment shall be a grit-free white powder suitable for use in paints.

1045.2.9 Basic Lead Silico Chromate. This pigment shall comply with ASTM D 1648-74.

1045.2.10 Barium Sulfate. This pigment shall comply with the requirements of ASTM D 602-42 (1975) for barytes.

1045.2.11 Titanium Dioxide. This pigment shall comply with the requirements of ASTM D 476-73, Type IV.

### 1045.3 Vehicle Constituents.

1045.3.1 Raw Linseed Oil. Raw linseed oil shall be the pure oil pressed from flax seed, and shall conform to the following requirements:

Specific Gravity, 25/25 C	0.926 to 0.931
Acid number, max	4.0
Saponification number	189 to 195
Unsaponifiable matter, percent, max	1.50
Iodine number (Wijs) min	177
Loss on heating at 105 to 110 C, percent max	0.3
Foots, percent by volume, max	
Heated oil	1.0
Chilled oil	4.0
Color—Not darker than a freshly prepared solution of 1.0 g of potassium dichromate in 100 ml of pure sulfuric acid of 1.84 specific gravity.	

1045.3.2 Heavy-Bodied and Refined Linseed Oil. This material shall meet the approval of the engineer.

1045.3.3 Drier. Drier shall consist of lead, manganese, or cobalt drying metals, or of a mixture of these elements combined with a suitable fatty acid, resins or gums, naphthenic acid and petroleum spirits or turpentine, or a mixture of these solvents. It shall be free of rosin. The drier shall conform to the following requirements except that color and lead requirements shall not apply to cobalt and manganese driers.

Appearance—The drier shall be a mobile liquid free from sediment and suspended matter, and shall show no clotting or gelatinization.

Color—The drier shall be of such color that, when mixed with pure raw linseed oil in the proportion of one volume of drier to 8 volumes of oil, the resulting solution shall be no darker than a solution of 3 g of potassium dichromate in 100 ml of pure sulfuric acid of 1.84 specific gravity.

Flash Point—Tag closed cup, not lower than 85 F.

Non-volatile matter—Not less than 50 percent.

Lead—The drier shall yield an ash which shall show, on analysis, not less than 10 percent lead, calculated as metallic lead.

Action with Linseed Oil—Drier shall mix with pure raw linseed oil in the proportion of one volume of drier to 19 volumes of oil, without curdling.

Drying Properties—The above mixture of drier with linseed oil (1:19), when flowed on glass, shall dry thoroughly in not more than 8 hours.

1045.3.4 Turpentine. This material shall be gum spirits of turpentine or steam-

distilled wood turpentine. Destructively-distilled wood turpentine or sulfate wood turpentine will not be permitted. It shall conform to the following requirements

Color- It shall be clear and free from suspended matter and water.

The color shall be "standard" or better.

Specific Gravity, 15.5/15.5 C	0.860 to 0.875
Initial boiling point	150 to 160 C
Distilling below 170 C, percent by volume, min	90.0

1045.3.5 Alkyd Resin. This material shall conform to Federal Specification TT-R-266d for Type III, medium oil linseed soya modified. Alkyd resin for basic lead silico chromate, first coat, green finish coat, and aluminum finish coat paints shall conform to Federal Specification TT-R-266d, Type I, Class A.

1045.3.6 Raw Tung Oil. This material shall meet the following requirements:

Appearance - Clear and transparent.

Specific Gravity, 25/25 C	0.935 to 0.938
American-grown Tung Oil	0.933 to 0.938
Acid Number (alcohol-benzol) max	8.0
Saponification Number	189 to 195
Unsaponifiable matter, percent, max	0.75
Iodine Number (Wijs), min	163
Gel Time, minutes, max	12

Beta Tung Oil will not be approved.

1045.3.7 Mineral Spirits. This material shall meet the following requirements:

Appearance- It shall be clear and free from suspended matter and water.

Color- Not darker than No. 21 Saybolt chromometer.

Flash Point- Tag closed cup, not lower than 85 F.

Blackening- It shall not blacken or corrode clean metallic copper in 30 minutes at the boiling point of the spirits.

Distillation- The distillate below 266 F (130 C) shall not exceed 5 percent by volume. The distillate below 446 F (230 C) shall be not less than 97 percent by volume.

Acidity- The residue after distillation shall be neutral.

1045.3.8 Xylol. This material shall conform to the following requirements:

Specific Gravity, 15.5/15.5C	0.850 to 0.870
------------------------------	----------------

Color- Not darker than No. 21 Saybolt chromometer.

Distillation

Recovery at 130 C, percent by volume, max	5.0
Recovery at 145 C, percent by volume, min	90.0
Dry Point, C, max	155
Non-volatile matter, max	0.005 g per 100 ml
Water	Not sufficient to show turbidity at 20 C.
Acidity	None
Copper corrosion	Shall show no discoloration on

Sulfur ..... a clean copper strip  
None

**1045.4 First Coat—Red Lead—For Steel.**

**1045.4.1 Pigment.** The pigment shall consist of:

	<i>Percent</i>
Red Lead .....	90.0 to 93.0
Magnesium Silicate and Silica in equal parts by weight .....	7.0 to 9.7
Montmorillonite (Bentone 34) - prewet with Methyl Alcohol .....	0.3 to 0.4

**1045.4.2 Vehicle.** The vehicle shall consist of raw linseed oil, turpentine, and sufficient drier to cause the applied paint to dry to touch in 5 hours and to dry thoroughly within 18 hours, but in no case shall the drier and turpentine exceed 10 percent of the vehicle.

**1045.4.3 Mixed Paint.** The mixed paint shall conform to the following requirements

	<i>Percent</i>
Pigment .....	76.0 to 79.0
Vehicle .....	21.0 to 24.0
Moisture, max .....	0.5
Coarse particles and skins (total retained on No. 325 sieve) based on pigment, max .....	1.5

**1045.5 First Coat Red Lead—Semi-Quick Drying—For Steel.**

**1045.5.1 Pigment.** The pigment shall consist of:

	<i>Percent</i>
Red Lead, min .....	99.6
Aluminum Stearate .....	0.3 to 0.4

**1045.5.2 Vehicle.** The vehicle shall consist of raw linseed oil blended with a glyceryl phthalate type varnish composed of a linseed oil modified resin and necessary driers and volatile thinners. It shall be free of rosin and rosin derivatives and shall be composed of:

	<i>Percent</i>
Raw linseed oil, min .....	27.0
Alkyd resin solids, (Type III) min .....	26.0
Volatile thinner and drier, max .....	47.0

**1045.5.3 Mixed Paint.** The mixed paint shall conform to the following requirements:

Pigment, percent .....	73.0 to 76.0
Vehicle, percent .....	24.0 to 27.0
Moisture, percent, max .....	0.5
Coarse particles and skins (total retained on No. 325 sieve) based on pigment, percent, max .....	1.0



distilled wood turpentine. Destructively-distilled wood turpentine or sulfate wood turpentine will not be permitted. It shall conform to the following requirements:

Color—It shall be clear and free from suspended matter and water.

The color shall be "standard" or better.

Specific Gravity, 15.5/15.5 C . . . . . 0.860 to 0.875

Initial boiling point . . . . . 150 to 160 C

Distilling below 170 C, percent

by volume, min . . . . . 90.0

**1045.3.5 Alkyd Resin.** This material shall conform to Federal Specification TT-R-266d for Type III, medium oil linseed soya modified. Alkyd resin for basic lead silico chromate, first coat, green finish coat, and aluminum finish coat paints shall conform to Federal Specification TT-R-266d, Type I, Class A.

**1045.3.6 Raw Tung Oil.** This material shall meet the following requirements:

Appearance - Clear and transparent.

Specific Gravity, 25/25 C . . . . . 0.935 to 0.938

American-grown Tung Oil . . . . . 0.933 to 0.938

Acid Number (alcohol-benzol) max . . . . . 8.0

Saponification Number . . . . . 189 to 195

Unsaponifiable matter, percent, max . . . . . 0.75

Iodine Number (Wijs), min . . . . . 163

Gel Time, minutes, max . . . . . 12

Beta Tung Oil will not be approved.

**1045.3.7 Mineral Spirits.** This material shall meet the following requirements:

Appearance—It shall be clear and free from suspended matter and water.

Color—Not darker than No. 21 Saybolt chromometer.

Flash Point—Tag closed cup, not lower than 85 F.

Blackening—It shall not blacken or corrode clean metallic copper in 30 minutes at the boiling point of the spirits.

Distillation—The distillate below 266 F (130 C) shall not exceed 5 percent by volume. The distillate below 446 F (230 C) shall be not less than 97 percent by volume.

Acidity—The residue after distillation shall be neutral.

**1045.3.8 Xylol.** This material shall conform to the following requirements:

Specific Gravity, 15.5/15.5C . . . . . 0.850 to 0.870

Color - Not darker than No. 21 Saybolt chromometer.

Distillation

Recovery at 130 C, percent by volume, max . . . . . 5.0

Recovery at 145 C, percent by volume, min . . . . . 90.0

Dry Point, C, max . . . . . 155

Non-volatile matter, max . . . . . 0.005 g per 100 ml

Water . . . . . Not sufficient to show turbidity at 20 C.

Acidity . . . . . None

Copper corrosion . . . . . Shall show no discoloration on

Weight per gallon, pounds, min .....	21.4
Drying Time: Dry to touch, hours, max .....	4
Dry thoroughly, hours, max .....	16

#### 1045.6 Second Coat-Brown-For Steel.

##### 1045.6.1 Pigment. The pigment shall consist of:

	<i>Percent</i>
Red Lead, min .....	65.0
Red Iron Oxide .....	10.0 to 12.0
Graphite .....	10.0 to 12.0
Magnesium Silicate .....	9.0 to 11.0
Aluminum Stearate .....	0.3 to 0.4

1045.6.2 Vehicle. The vehicle shall consist of raw linseed oil, turpentine, and sufficient drier to cause the applied paint to dry to touch in 5 hours and to dry thoroughly within 18 hours, but in no case shall the drier and turpentine exceed 25 percent of the vehicle.

##### 1045.6.3 Mixed Paint. The mixed paint shall conform to the following requirements:

	<i>Percent</i>
Pigment .....	65.0 to 68.0
Vehicle .....	32.0 to 35.0
Moisture, max .....	0.5
Coarse particles and skins (total retained on No. 325 sieve) based on pigment, max .....	1.5

1045.7 Final Coat-Light Gray-For Steel. Gray paint shall conform to Federal Specification TT-P-81d. Other formulations of similar composition may be approved by the engineer. The paint shall be of a shade approved by the engineer.

1045.8 Paint-White and Gray-For Wood. White paint shall conform to Federal Specification TT-P-102a, Class A. Gray paint shall conform to Federal Specification TT-P-102a, Class B and be of a shade approved by the engineer. Other formulations of similar composition may be approved by the engineer. Paint to be used for prime and undercoat shall be thinned with not more than one-half pint of turpentine and one quart of linseed oil per gallon as required to obtain proper brushing and hiding consistency.

#### 1045.9 Aluminum Paint-Constituents-For Steel.

1045.9.1 Aluminum Pigment. Aluminum paste shall comply with ASTM D 962-66(1973), Type 2, Class B.

1045.9.2 Vehicle. The vehicle shall be varnish meeting the following requirements:

Color - The varnish shall be clear and transparent. The color shall be no darker than a solution of 2 g of potassium dichromate in 100 ml of pure sulfuric acid of 1.84 specific gravity.

Nonvolatile Oils and Gums - Not less than 50 percent by weight of nonvolatile oils

and gums. The nonvolatile oil portion shall consist of not less than 75 percent raw tung oil, the remainder to be heavy-bodied and refined linseed or other suitable oils. The nonvolatile resin portion shall be free from rosin.

**Kaun Reduction** - The varnish shall pass a 120 percent Kauri reduction test at 25 C, when tested in accordance with Method B of ASTM D 1642-70.

**Drying Time** - The varnish shall dry to touch in not less than 2 nor more than 6 hours, and shall dry thoroughly within 16 hours.

**Viscosity** - The viscosity at 25 C shall be not less than 0.65 and not more than 1.25 poises corresponding to Gardner-Holdt tubes B to E.

**Consistency** - The varnish shall be of such consistency that, when thoroughly mixed in the specified proportions with aluminum paste, the paint shows satisfactory spreading qualities and does not run or sag when applied to a vertical surface. When the paste is mixed with the vehicle in the specified proportions, it shall show leafing properties meeting the approval of the engineer.

**Water Resistance** - The dried films, prepared in accordance with ASTM D 1647-70, shall withstand cold water for 18 hours and boiling water for 15 minutes without showing any whitening or dulling immediately upon removal from the water.

**Skinning** - The varnish shall show no skinning after 72 hours when placed in a tightly closed, half-filled, one-pint, friction-top container.

#### 1045.10 Aluminum Paint.

**1045.10.1 Composition.** The paint shall be of the following composition:

Aluminum paste	3.0 pounds
Vehicle	1.0 gallon

**1045.10.2 Consistency.** The aluminum paint shall be of such consistency as to have satisfactory spreading qualities and shall not run or sag when applied to a vertical surface.

**1045.10.3 Drying Time.** The paint shall dry to touch in not less than 2 nor more than 10 hours, and shall dry thoroughly within 24 hours.

#### 1045.11 First Coat - Basic Lead Silico Chromate Paint.

**1045.11.1 Pigment.** The pigment shall consist of:

	Percent
Basic Lead Silico Chromate, min	94.0
Montmorillonite (Bentone 38)- prewet with Methyl Alcohol	0.5 to 0.7
Pure Red Iron Oxide	3.0 to 5.3

**1045.11.2 Vehicle.** The vehicle shall consist of raw linseed oil, alkyd resin solution, and necessary driers and volatile thinners. The vehicle shall be free of rosin and rosin derivatives and shall be composed of:

	<i>Percent</i>
Raw Linseed Oil, min. ....	45.0
Alkyd Resin Solids (Type I, Class A) ....	20.0 to 22.0
Volatile Thinner and Driers, max. ....	31.0

1045.11.3 Mixed Paint. Mixed paint shall conform to the following requirements:

Pigment, percent, min. ....	64.0
Vehicle, percent, max. ....	36.0
Moisture, percent, max. ....	0.5
Coarse particles and skins (total retained on No. 325 sieve) based on pigment, percent, max. ....	1.0
Consistency (Krebs-Stormer 77 F) - KU ....	74-85
Weight per gallon, pounds, min. ....	14.9
Drying Time:	
Set to touch, hours, max. ....	6
Dry thoroughly, hours, max. ....	36
Fineness of Grind, Hegman gage, min. ....	4
Skinning - The primer shall not skin within 48 hours in a tightly closed, three-quarter filled, one-pint, friction-top container.	

1045.12 Second Coat—Maroon—Basic Lead Silico Chromate Paint.

1045.12.1 Pigment. The pigment shall consist of:

	<i>Percent</i>
Basic Lead Silico Chromate, min. ....	74.0
Red Iron Oxide, max. ....	25.6
Montmorillonite (Bentone 38) - prewet with Methyl Alcohol ....	0.4 to 0.5

1045.12.2 Vehicle. The vehicle shall be composed of raw linseed oil, alkyd resin solution, mineral spirits, and sufficient drier to cause the paint to set to touch in 4 hours, and to dry thoroughly in less than 18 hours, but in no case shall the drier and mineral spirits exceed 16 percent of the vehicle. The vehicle shall be free from rosin, rosin derivatives, and show a negative phenol test. The vehicle ingredients shall be mixed in the following proportions:

	<i>Percent</i>
Raw Linseed Oil, Min. ....	28.0
Alkyd Resin Solids (Type III), min. ....	28.0
Mineral Spirits and Driers, max. ....	44.0

1045.12.3 Mixed Paint. Mixed paint shall conform to the following requirements:

Pigment, percent ....	57.0 to 59.0
Vehicle, percent ....	41.0 to 43.0

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Missouri State Highway Commission  
P.O. Box 270  
Jefferson City, MO 65102  
Phone (314) 751-2551

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Moisture, percent, max .....	0.3
Consistency (Krebs-Stormer, 77 F)- KU .....	71 to 85
Fineness of Grind, Hegman Gage, min. ....	3½

**1045.13 Finish Coat—Aluminum—Basic Lead Silico Chromate Paint.**

**1045.13.1 Pigment.** Pigment shall consist of:

	<i>Percent</i>
Basic Lead Silico Chromate .....	42.0 to 45.0
Aluminum Pigment .....	55.0 to 58.0

**1045.13.2 Vehicle.** The vehicle shall contain not less than 47.5 percent alkyd resin solids (Type 1). The remainder shall be mineral spirits, leafing stabilizer, and driers. Driers shall be a mixture of zirconium catalyst, cobalt naphthenate, and manganese naphthenate.

After accurately determining the acid number of the vehicle and before adding driers, 4 ounces of Alcoa Stabilizer No. 5 per acid number, per 100 pounds of vehicle solids shall be added. The vehicle, with stabilizer added, shall stand for at least 18 hours before mixing with the aluminum paste.

**1045.13.3 Mixed Paint** shall conform to the following requirements:

	<i>Min.</i>	<i>Max.</i>
Pigment, percent .....	22.0	....
Vehicle, percent .....	....	78.0
Weight per Gallon, pounds .....	8.8	....
Water, percent .....	....	0.5
Coarse Particles and Skins (total retained on 325 sieve), based on pigment, percent .....	....	1.0
Consistency: (Krebs-Stormer 77 F)-KU .....	66	76
Drying Time: Set-to-touch, hours .....	....	1½
Dry thoroughly, hours .....	....	8

The basic lead silico chromate pigment shall be ground in a portion of the alkyd vehicle before it is mixed with the aluminum paste. The fineness of grind (Hegman Gage) of the basic lead silico chromate portion of the paint shall be a minimum of four. Driers shall not be added until after mixing the ground basic lead silico chromate portion, stabilized vehicle, and aluminum paste.

**1045.14 Finish Coat—Green—Basic Lead Silico Chromate Paint.**

**1045.14.1 Pigment.** Pigment shall consist of:

	<i>Percent</i>	
	<i>Min.</i>	<i>Max.</i>
Basic Lead Silico Chromate .....	47.0	....
Titanium Dioxide .....	20.0	25.0
Phthalocyanine Green and Auxiliary Toning Colors* .....	1.0	3.0
Montmorillonite (Bentone 38)-prewet with Methyl Alcohol .....	0.6	1.5
Barytes .....	....	27.0

\*Auxiliary toning colors may be chromium oxide green ASTM D 263-46 (1970) or phthalocyanine blue ASTM D 963-65 (1975).

1045.14.2 Vehicle. Vehicle shall consist of:

	Percent	
	Min.	Max.
Raw Linseed Oil .....	4.5	6.6
Alkyd Resin Solids (Type I) .....	49.0	....
Mineral Spirits**, Driers, and Antiskinning Agent .....		44.5

\*\*As part of the volatile in the vehicle, the paint manufacturer is permitted to add not more than 1.1 gallons of ethylene glycol monoethyl ether per 100 gallons of paint.

1045.14.3 Mixed Paint. Mixed paint shall meet the following requirements:

	Min.	Max.
Pigment, percent .....	38.5	41.5
Vehicle, percent .....	58.5	61.5
Nonvolatile Vehicle by Weight (on vehicle basis), percent .....	54.0	....
Weight per gallon, pounds .....	10.7	....
Water, percent .....		1.0
Coarse Particles and Skins, (total retained on No. 325 sieve) based on pigment, percent .....		1.0
Fineness of Grind (Hegman gage) .....	5	....
Consistency (Krebs-Stormer, 77 F) - KU .....	70	80
Drying Time: Set-to-touch, hours .....		4
Dry thoroughly, hours .....		16

Color shall match Color No. 24260 of Federal Standard No. 595 a.

1045.15 Inorganic Zinc Silicate Paint. Inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed, and applied in accordance with the requirements of Sec 712, cures without the use of a separate curing solution, and shall have the properties described herein.

1045.15.1 Pigment. The zinc pigment component shall comply with the requirements of ASTM D 520-51 (1970) for Type II.

1045.15.2 Vehicle. The vehicle component shall consist primarily of an alkyl silicate in an appropriate alcohol solvent. Total solids, by weight, in the vehicle component shall not be less than 21 nor more than 45 percent. The solids content shall be determined by drying the sample to a constant weight at 100 C.

1045.15.3 Mixed Paint. Mixed paint shall conform to the following requirements:

(a) The zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.

(b) The total solids, when heated at 100 C for 3 hours, shall be not less than 80 percent by weight.

(c) The paint shall tolerate up to one percent water contamination without gellation.

(d) The usable pot life of the mixed paint shall be not less than 12 hours at 77 F. There shall be no hard settling which cannot be easily redispersed during this period.

(e) The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the vinyl finish coat.

**1045.15.4 Resistance Tests.** Test panels of steel meeting the requirements of ASTM D 609-73 having dimensions of 2 by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to the same degree specified under Sec 712.12. A 3-mil coating (dry thickness) shall then be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. The material will not be accepted if any individual test panel fails any of the following tests:

(a) **Fresh Water Resistance.** Panels shall be scribed down to base metal with an X of at least 2-inch legs and shall be immersed in fresh tap water at  $75\text{ F} \pm 5\text{ F}$ . The panels shall show no rusting, blistering, or softening when examined after 30 days.

(b) **Salt Water Resistance.** Panels shall be scribed down to base metal with an X of at least 2-inch legs and immersed in 5 percent sodium chloride at  $75\text{ F} \pm 5\text{ F}$ . The panels shall show no rusting, blistering, or softening upon examination after 7, 14 and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.

(c) **Weathering Resistance.** Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel, or blistering.

(d) **Weathering and Salt Fog Resistance.** Panels shall be tested in the weatherometer as specified in (c) for 300 hours. After this period the panels shall be removed and scribed with an X of at least 2-inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-73. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

(e) **Resistance to Elevated Temperatures and Thermal Shock.** Panels shall be exposed to a temperature of 500 F for one hour, then quenched immediately in  $65\text{ F} \pm 5\text{ F}$  water. Panels subjected to this test shall show no blistering or flaking of the coating.

**1045.15.5 Manufacturer and Brand Name Approval for Inorganic Zinc Primer.** Prior to approval and use of inorganic zinc, the contractor shall submit in triplicate to the engineer a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative and resistance test require-



ments of these specifications. The certified test report shall also contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the engineer of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of 2 years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed, and may be required by the engineer when sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

**1045.16 Finish Coat—Green—Vinyl Paint.** Vinyl paint for the finish coat shall display compatibility with and adhesion to the cured inorganic zinc primer coat.

**1045.16.1 Vehicle.** The vehicle shall consist essentially of vinyl chloride-vinyl acetate copolymer resins dissolved in aromatic or ketone-aromatic solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

**1045.16.2 Mixed Paint.**

**1045.16.2.1** Vinyl paint for the finish coat shall contain not less than 29 percent pigment by weight and 19 percent vehicle solids by weight, for a total solids content of not less than 48 percent by weight. Total weight per gallon at 77 F shall be  $10.0 \pm 1.0$  pounds.

**1045.16.2.2** The vinyl paint shall air dry at a temperature of 77 F to a hard tough film within 4 hours, entirely as a result of evaporation of solvent. The paint film shall dry to touch in not more than 20 minutes at 77 F.

**1045.16.2.3** The vinyl finish coat shall be light green, matching color No. 24260 of Federal Standards No. 595 a.

Delete Sec 1045.2.6 and substitute the following:

1045.2.6 Pure Red Iron Oxide. This pigment shall comply with the requirements of ASTM D 3721-78.

1045.3.5 Alkyd Resin. This material shall conform to Federal Specification TT-R-266d for Type III, medium oil linseed soya modified. Alkyd resin for basic lead silico chromate standard drying primer-Type V, green finish coat, and aluminium finish coat paints shall conform to Federal Specification TT-R-266d, Type I, Class A.

Delete Sec 1045.11 and substitute the following:

1045.11 First Coat-Basic Lead Silico Chromate Paints.

1045.11.1 Semi-Quick Drying Primer (Federal Designation Type II).

1045.11.1.1 Pigment. The pigment shall consist of:

	Percent
Basic Lead Silico Chromate, min	93.2
Montmorillonite (Bentone 38) - prewet with Methyl Alcohol	0.5 to 0.7
Red Iron Oxide	5.0 to 7.0

1045.11.1.2 Vehicle. The vehicle shall consist of raw linseed oil, alkyd resin solution, and necessary driers and volatile thinners. The vehicle shall be free of rosin and rosin derivatives and shall be composed of:

	Percent
Raw Linseed Oil, min	26.0
Alkyd Resin Solids (Type III), min	26.0
Volatile Thinner and Driers, max	48.0

1045.11.1.3 Mixed Paint. Mixed Paint shall conform to the following requirements:

Pigment, percent, min	57.0
Vehicle, percent, max	43.0
Moisture, percent, max	0.5
Coarse particles and skins (total retained on No. 325 sieve) based on pigment, percent, max	1.0
Consistency (Krebs-Stormer 77F) - KU	70-83
Weight per gallon, pounds, min	13.5
Drying Time:	
Set to touch, hours, max	4
Dry thoroughly, hours, max	16
Fineness of Grind, Hegman gage, min	4
Skinning - The primer shall not skin within 48 hours in a tightly closed, three-quarter filled, one-pint, friction-top container.	

1045.11.2 Standard Drying Primer (Federal Designation Type V).

1045.11.2.1 Pigment. The pigment shall consist of:

Basic Lead Silico Chromate, min	Percent 94.0
Montmorillonite (Bentone 38) - prewet with Methyl Alcohol	0.5 to 0.7
Pure Red Iron Oxide	3.0 to 5.3

1045.11.2.2 Vehicle. The vehicle shall consist of raw linseed oil, alkyd resin solution, and necessary driers and volatile thinners. The vehicle shall be free of rosin and rosin derivatives and shall be composed of:

Raw Linseed Oil, min	Percent 45.0
Alkyd Resin Solids (Type I, Class A)	20.0 to 22.0
Volatile Thinner and Driers, max	31.0

1045.11.2.3 Mixed Paint. Mixed paint shall conform to the following requirements:

Pigment, percent, min	64.0
Vehicle, percent, max	36.0
Moisture, percent, max	0.5
Coarse particles and skins (total retained on No. 325 Sieve) based on pigment, percent, max	1.0
Consistency (Krebs-Stormer 77 F) - KU	74-85
Weight per gallon, pounds, min	14.9
Drying Time:	
Set to touch, hours, max	6
Dry thoroughly, hours, max	36
Fineness of Grind, Hegman gage, min.	4
Skinning - The primer shall not skin within 48 hours in a tightly closed, three-quarter filled, one-pint, friction-top container.	

Delete Sec 1045.15.5 and substitute the following:

1045.15.5 Manufacturer and Brand Name Approval for Inorganic Zinc Primer. Prior to approval and use of inorganic zinc, the contractor shall submit in triplicate to the engineer a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative and resistance test requirements of these specifications. The certified test report shall also contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the engineer of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed, and may be required by the engineer when sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

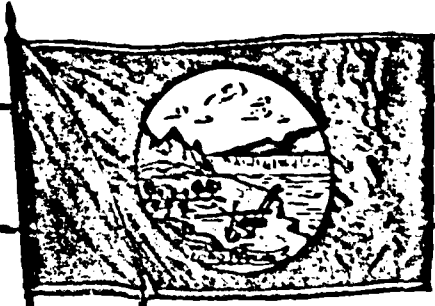
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#### SECTION 1050 LUMBER, TIMBER, PILING, POSTS, AND POLES

May 1978

Delete Sec 1050.7 and substitute the following:

1050.7 Posts for Signs. Rectangular posts for signs shall be Douglas Fir of the West Coast Region or Southern pine, as defined in ASTM D 1165-52(1976). The posts shall be surfaced four sides (S4S) with square cut ends, and shall be of the grade, size, and length shown on the plans. They shall be pressure treated with pentachlorophenol solution in accordance with the requirements of AWPAC 2-74(75), except that the final retention of pentachlorophenol shall be



STATE OF MONTANA  
DEPARTMENT OF HIGHWAYS

3 00 P.M.

WFO

CT. 3 - WFO

September 26, 1979

Mr. Fred Ordway  
Executive Vice-President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Sir:

Per your request on the use and specifications dealing with zinc rich paints, I offer the following.

The Montana Department of Highways does not use zinc rich paint as a primer or finish coat on their steel structures. Basic Lead Silico Chromate (TTP-615D-Type 2) is the paint primer that we use on our steel structures. Ready Mix Aluminum (TTP-38) and Zinc Phosphate (specifications attached) are the paints that we use for the final finish coat on steel structures.

Please advise if additional information is needed.

Sincerely,

Gene McMahon  
Chemist Supervisor

GM/sm/3G

# PAINTS

Art. M. 280.02

(4) The color shall be a dense lustrous black.

(5) At 70°F. the paint shall dry to touch in 20 minutes and dry free from tackiness in 45 minutes.

## (18) Dark Olive Green Finish Coat:

(A) **General Requirements.** All paints shall be well ground and show no skinning in a freshly opened full can. Paints shall not cake in the container or settle badly and shall be capable of being readily broken up with a paddle to smooth uniform consistency. Paints shall brush easily, possess good leveling and dry to a hard, uniform finish. The composition of the paints shall meet the following requirements.

	Min.	Max.
Pigment	59.0%	
Vehicle		41.0%
Pigment Portion		
Basic Lead Silico-Chromate	88.0%	
Chromium Oxide Green	9.0%	
Phthalocanine Green	0.7%	
Bentone 34	0.3%	0.7%
Vehicle Portion		
Raw Linseed Oil	45.0%	
Alkyd Resin Solids (TT-R-266, Type I)	28.0%	
Mineral Spirits and Driers		27.0%
Finished Paint		
Consistency (Krebs Stormer)	74 KU	84 KU
Weight Per Gallon	14.1 lb	
Dry to Touch		8 Hr

## (19) Montana Blue or Montana Brown

(A) **General Requirements.** The shop and first field coat shall be in accordance with Section 91 of the Standard Specifications. The second field coat shall be either, Montana Blue, No. 55-10 or Montana Brown, No. 76-23, whichever is called for on the plans. Either color shall match the appropriate color chip which is available, upon request, from the State of Montana, Department of Highways, Materials Bureau, Helena, Montana 59601.

All paints shall be well ground and show no skinning in a freshly opened full can. Paints shall not cake in the container or settle badly and shall be capable of being readily broken up with a paddle to smooth uniform consistency. Paints shall brush easily, possess good leveling and

Art. M-280 02

dry to a hard uniform finish. The composition of the Montana Blue and the Montana Brown paint shall meet the following requirements.

	Min.	Max.
Pigment.....	56.5%	58.5%
Vehicle.....	41.5%	43.5%
Pigment Portion:		
Zinc Phosphate.....	60.0%	.....
Titanium Dioxide (Rutile).....	13.0%	.....
Calcium Carbonate.....	21.4%	.....
Vehicle Portion:		
Alkyd Phthalic Resin (50% Solids).....	52.4%	.....
Raw Linseed Oil.....	26.2%	.....
Mineral Spirits.....	17.2%	.....
Driers and Additives.....	4.2%	.....
Finished Paint		
Consistency (Krebs-Stormer).....	70 K.U.	83 K.U.
Weight Per Gallon.....	12.6 lbs.	.....
Dry to Touch.....	.....	8 Hours
Dry to Handle.....	.....	16 Hours
Dry Film Thickness.....	1.0 Mil	.....

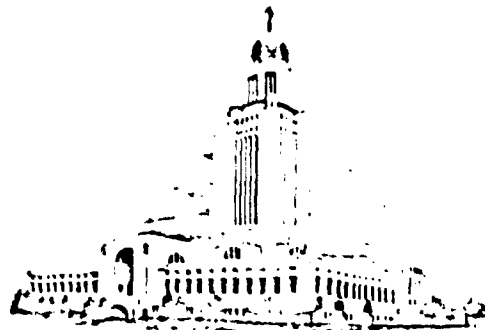
For additional requirements for painting see Section 91 of the Standard Specifications

# State of Nebraska

CHARLES THONE, GOVERNOR

DEPARTMENT OF ROADS  
DIRECTOR STATE ENGINEER  
DAVID O. COOLIDGE

P.O. BOX 94759  
LINCOLN, NEBR. 68509  
402 477 6012



Mr. Fred Ordway  
Executive Vice President  
ARTECH CORPORATION  
2901 Teleslar Ct.  
Falls Church, VA 22042

September 27, 1979

Dear Mr. Ordway:

We are in receipt of your letter of September 19, 1979 requesting information on zinc-rich paints used by the Nebraska Department of Roads.

Enclosed is a copy of a zinc-rich specification from our Standard Specifications.

Very truly yours,

DEPARTMENT OF ROADS

A handwritten signature in cursive script, appearing to read "A. J. Zuick".

Chemical & Physical Tests Manager

AJZuick/bs

Enclosure (1)

Address: Nebraska Department of Roads  
Materials and Tests Division  
P.O. Box 94759  
Lincoln, Nebraska 68509

(3) This is a semiprepared primer, with the zinc oxide mill-ground in the entire vehicle in one container and the zinc dust in a separate container. For mixing, the zinc dust should have a small portion of the zinc oxide-vehicle added to it and mixed to a smooth paste, after which the balance is gradually added and thoroughly mixed to a homogenous state.

(4) The proportions of zinc dust and of zinc oxide-vehicle required for preparing one gallon of ready-to-use paint are approximately as follows:

Zinc Dust, pounds	8.5
Zinc Oxide-Vehicle, pounds	8.1

(5) The paint may be applied by brushing or spraying. For spraying the primer, add one pint of thinner (conforming to Federal Specification TT-T-306 B) to each gallon of primer. The spreading rate should be approximately 600 square feet per gallon.

CAUTION—Keep paint away from flames. Provide adequate ventilation while applying the paint. Avoid prolonged inhalation of vapors.

## → 5. Zinc-Rich Primer

a. Zinc-rich primer is intended for use as a prime coat for structural steel.

### b. Primer Composition

Pigment, percent by weight	80 Min.
Vehicle, percent by weight	20 Max.
Weight per Gallon, 77 F, pounds	25 Typical
Total Solids, percent by weight	84 Min.
Zinc Dust, percent by weight of film forming solids	94 Min.

### c. Pigment Composition

(1) The pigment portion shall be made up as follows (percent by weight):

Zinc Dust	99.5 Min.
Suspending Agents	0.5 Max.





9/27/79

WE'LL INCLUDE  
THIS IN COMMENTS

ARTECH CORP. 2901 Telestar Court Falls Church, Virginia 22042 (703) 560-3292

September 19, 1979

Mr. Philip McIntyre  
Materials and Research Engineer  
Department of Public Works and Highways  
85 Loudon Road  
Concord, New Hampshire 03301

RECEIVED

MAINTENANCE DIVISION

SEP 21 1979

NEW HAMPSHIRE DEPARTMENT  
OF PUBLIC WORKS & HIGHWAYS

Dear Sir:

We are compiling for the Navy a comparison of all the specifications now in use or proposed for zinc-rich paints or primers (both the inorganic and organic types). If you have such a specification, we should very much like to obtain a copy. If you employ a specification issued by a national organization, such as the Steel Structures Painting Council, a reference to their designation would also be appreciated. The information should be addressed for my attention - a return envelope is enclosed.

We are grateful for your cooperation. The results will benefit our Navy and ultimately will help to improve the quality and economy of the nation's rust-protection technology.

Sincerely yours,

ARTECH CORP.

*Fred Ordway*

Fred Ordway  
Executive Vice President

FO/jb

*New Hampshire does not currently have  
any specifications for zinc-rich paints except for  
2 primers. For this, we follow ASTM D-21035*

4 OCT 1979

H - 188

Consumer Protection • Power Sources • Materials • Instrumentation • Testing • Analysis



IN REPLY PLEASE REFER TO

State of New Jersey  
DEPARTMENT OF TRANSPORTATION

LOUIS J. GAMBACCINI  
COMMISSIONER

1035 PARKWAY AVENUE  
P.O. BOX 101  
TRENTON, NEW JERSEY 08625

October 11, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, VA 22042

Dear Mr. Ordway:

In response to your recent request, one zinc-rich organic type coating has been proposed for New Jersey Zone 3B marine, severe exposure as a primer and intermediate coat.

It is described on page 15 of the attached.

Related coatings and a map of the exposure zones are also enclosed.

Please let us know if we can be of further assistance.

Very truly yours,

E. Robert Wokoun, Chief  
Bureau of Quality Control

ERW:GC:jvw

Enclosures



IN REPLY PLEASE REFER TO  
STRUCTURAL DESIGN  
INSTRUCTION NO. 74-2

## State of New Jersey

### DEPARTMENT OF TRANSPORTATION

March 15, 1974

ALAN SAGNER  
COMMISSIONER

100 SOUTH AVENUE  
TRENTON, NEW JERSEY 08625

SUBJECT: STRUCTURAL STEEL,  
Cleaning and Painting, Zone Systems

#### COMMENTARY

The Department's Bureau of Quality Control has recently completed a study to determine the exposure effects of air pollutants and sea salt on structural paint. The levels at which these factors preclude the use of one paint specification over another and the state-wide distribution of these factors were defined. The primary objective is to set the type of paint specifications that are to be used on structures that are influenced by these two factors.

#### INDUSTRIAL POLLUTANTS

Though pollutant levels are relatively high in certain sections of the state as compared to ambient air quality standards, there is no evidence to show that repainting schedules are adversely affected. Thus industrial and rural areas should normally be considered comparable with regard to the use of structural paint. Unusual situations such as structures over or near factories will require individual study.

#### SEA SALT

The effect of salt splash water on the deterioration of structural paint is dependent upon its salinity. Waters with salinity high enough to require appropriate paint specifications include all coastal waters (Bays, Harbors, etc.) and coastal parts of tidal rivers. Splash zones of rivers are specified by the following table (Also See Enclosure 1):

March 15, 1974

River	Salt Splash Zone extends to
Delaware . . . . .	Bridgeport, N. J.
Hullica . . . . .	14th Mile of River's Length
Hudson . . . . .	New York Border
All other tidal rivers . . . . .	15th Mile of River

Note: (Salt splash zones are areas 15 ft. or less  
above the high water level)

Certain areas of the state through their configuration with the ocean are subjected to high concentrations of sea salt suspended in the air. Such salt intrusion would generally be limited to a two mile coastal region. (See Enclosure -1).

The alternative to using special paint systems for structures in the cited areas is to raise the steel of the structures well above the salt splash zones. A cost estimate study will be required to justify such a step.

#### CONCLUSION

Effective immediately, the guidelines established in Enclosure No. 2 shall govern the selection of structural steel cleaning and painting systems.

Standard supplementary specifications for basic lead silico chromate paints have been previously issued and are currently in use. Standard supplementary specifications for zinc-rich paint and vinyl paint are being developed and will be issued in the near future.

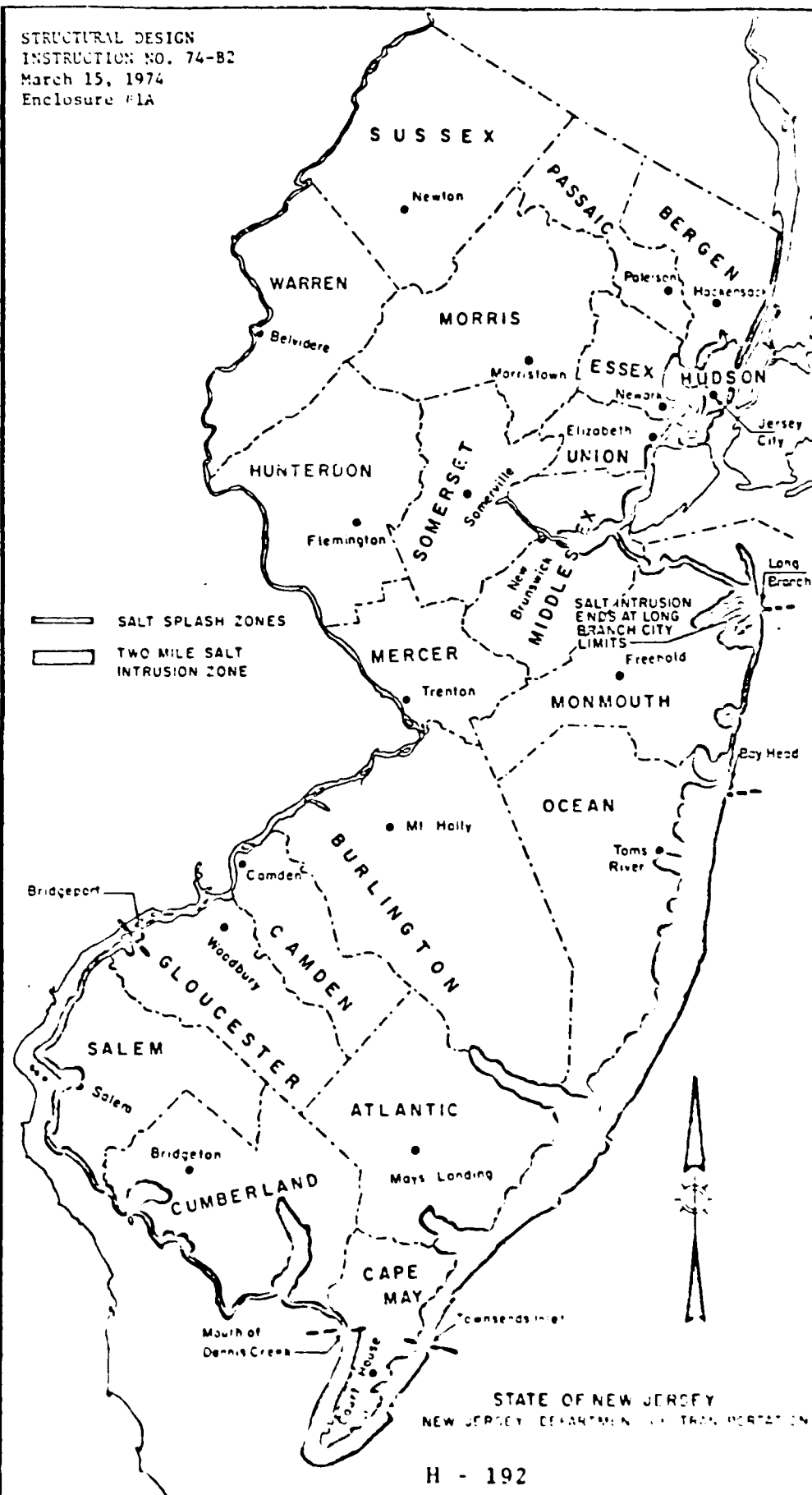
Enc. (2)

JTA:mg

*Warren J. Underland*  
Warren J. Underland, Chief  
Bureau of Structural Design

# ZONAL AREAS OF NEW JERSEY AFFECTED BY SALINITY

STRUCTURAL DESIGN  
INSTRUCTION NO. 74-B2  
March 15, 1974  
Enclosure #1A



STRUCTURAL DESIGN  
INSTRUCTION NO. 74-B2

March 15, 1974

Enclosure # 1B

For clarification purposes the following notes are included with the attached map (Enclosure No. 1A).

Note: A rivers point of measurement is to start where the mouth noticeably changes into bay or ocean.

Examples: Hackensack and Passaic Rivers - Newark Bay  
Mullica River - Great Bay  
Raritan River - Line parallel from South  
Amboy to opposite coastline  
Shrewsbury River - Sea Bright Bridge

Note: Sea Salt intrusion-areas surrounded on three sides by salt water (penninsula, protrusion) such that at least one side faces open ocean; or those land masses completely surrounded by salt water.

On Map:

1. Except for the Delaware and Hudson Rivers, designated splash zones are only approximations of splash zones on rivers.
2. Dashed lines denote transition points from splash zones to two mile intrusion zones.



# State of New Jersey

## DEPARTMENT OF TRANSPORTATION

1035 PARKWAY AVENUE  
TRENTON, NEW JERSEY 08625

ALAN SAGNER  
COMMISSIONER

IN REPLY PLEASE REFER TO

STRUCTURAL DESIGN  
INSTRUCTION NO. 74-10

March 15, 1974

Enclosure No. 2

### STRUCTURAL STEEL CLEANING AND PAINTING SCHEDULES

ZONE	ENVIRONMENT	SURFACE PREPARATION	PAINT
1	Rural or industrial, mild exposure. Where severe corrosion is not a problem.	Commercial Blast Cleaning SSPC-SP 6.	Primer: Basic Lead Silico Chromate Intermediate: Basic Lead Silico Chromate. Finish: Basic Lead Silico Chromate.
2	Industrial, severe exposure. Area where corrosion is a serious problem. Progressively aggressive industrial locations.	White Metal Blast Cleaning SSPC-SP 5.	Wash: Vinyl Wash. Primer: Basic Lead Silico Chromate Vinyl. Intermediate: Basic Lead Silico Chromate Vinyl. Finish: Vinyl.
3A	Marine, mild exposure. Structural steel more than 15 feet above mean high water. Structure located in less severe coastal salt intrusion zone.	Commercial Blast Cleaning SSPC-SP 6.	Primer: Basic Lead Silico Chromate Intermediate: Basic Lead Silico Chromate. Finish: Basic Lead Silico Chromate.
3B	Marine, severe exposure. Structural steel less than 15 feet above mean high water. Structure located in severe coastal salt intrusion zone.	White Metal Blast Cleaning SSPC-SP 5.	Primer: Organic Zinc-Rich. Intermediate: Organic Zinc-Rich. Wash: Vinyl Wash. Finish: Vinyl.



State of New Jersey

DEPARTMENT OF TRANSPORTATION

ALAN SAGNER  
COMMISSIONER

1035 PARKWAY AVENUE  
TRENTON, NEW JERSEY 08625

Structural Design  
Instruction No. 74-23  
Page 1 of 11

July 15, 1974

SUBJECT: STRUCTURAL STEEL,  
Cleaning and Painting Specifications

Structural Design Instruction No. 74-B2 (3/15/74) established guidelines for zone systems for cleaning and painting. This Instruction provides specifications to implement the requirements, effective immediately.

In the Computer Listing - Supplementary Specifications - Bridge on Pages E-IV-38, 39, 40 delete the provisions from line 71 to 125 under PAINTING and substitute the enclosed appropriate specifications on a project to project basis. Material specifications for additional paint types are also included and should be added to DIVISION 8 SECTION 6 PAINTS.

The selection of the system (and color of finish coat) shall be the responsibility of the design unit. It shall be based on the guidelines established in Structural Design Instruction No. 74-B2. Concurrence of the selection will be made at the time of the Phase 3 Plan Review.

The following shall be included with the general notes on the structural steel plans:

Cleaning and Painting: As specified for Zone \_\_\_\_\_ System

Finish Coat Color: \_\_\_\_\_

Warren J. Sunderland, Chief  
Bureau of Structural Design

JTH:DL





## State of New Jersey

### DEPARTMENT OF TRANSPORTATION

1005 PARKWAY AVENUE  
TRENTON, NEW JERSEY 08625

Structural Design  
Instruction No. 74-1

ALAN SALNET  
COMMISSIONER

#### DIVISION 4

#### SECTION 3

#### STEEL STRUCTURES

#### 4.3.3. METHODS OF CONSTRUCTION

##### PAINTING

THE PROVISIONS IN THE STANDARD SPECIFICATIONS, BEGINNING WITH THE FIRST FULL PARAGRAPH ON PAGE 246 AND ENDING WITH THE FIRST FULL PARAGRAPH ON PAGE 247, ARE DELETED AND THE FOLLOWING SUBSTITUTED THEREFOR.

CLEANING AND PAINTING OF STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS FOR THE COSE SYSTEM SPECIFIED ON PLANS.

COLOR OF FINISH COAT SHALL BE BLUE OR GREEN, WHICHEVER IS SPECIFIED ON PLANS.

ALL REFERENCES TO "SSPC" IN THE FOLLOWING PROVISIONS REFER TO SPECIFICATIONS PUBLISHED BY THE STEEL STRUCTURES PAINTING COUNCIL, 4400 FIFTH AVENUE, PITTSBURGH, PENNSYLVANIA.

SURFACES OF STEEL WHICH WILL BE IN CONTACT WITH OR EMBEDDED IN CONCRETE SHALL BE GIVEN ONE PRIME COAT OF PAINT.

SURFACES WITHIN 2 INCHES OF FIELD WELDS SHALL NOT BE PAINTED, BUT SHALL RECEIVE A LIGHT COAT OF APPROVED RUST INHIBITIVE COATING.

CONTACT SURFACES AT JOINTS MADE WITH HIGH STRENGTH BOLTS SHALL BE FREE OF OIL, PAINT, LACQUER, OR GALVANIZING.

ROLLERS AND MACHINED SURFACES SHALL BE COATED WITH HARD GREASE WHICH WILL READILY ADHERE TO THE METAL IN COLD AND HOT WEATHER, OR SHALL BE COATED WITH A MIXTURE OF WHITE LEAD AND TALLOW, OR A CORROSIVE PREVENTIVE COMPOUND MEETING THE REQUIREMENTS OF MIL-C-117-2 CLASS 3. THE COATING SHALL BE APPLIED AS SOON AS PRACTICABLE AFTER BEING ACCEPTED AND BEFORE REMOVAL FROM THE SHOP.

ZONE 1 SYSTEM

ZONE 3A SYSTEM

TYPE: BASIC LEAD SILICO CHROMATE PRIMER, INTERMEDIATE COAT, AND FINISH COAT.

SURFACE PREPARATION: "COMMERCIAL BLAST CLEANING" SSPC-SP6 FOLLOWED IMMEDIATELY (4 HOURS MAXIMUM) BY SHOP PRIMER.

PAINT APPLICATION: ALL PAINT SHALL BE APPLIED IN ACCORDANCE WITH SSPC-PA 1-64, "SHOP, FIELD, AND MAINTENANCE PAINTING."

NUMBER OF COATS: A MINIMUM NUMBER OF 3 COATS SHALL BE APPLIED; PRIME COAT IN THE SHOP; INTERMEDIATE COAT IN THE FIELD (EXCEPT WHEN ZONE 3A IS SPECIFIED, INTERMEDIATE COAT MAY BE APPLIED IN THE SHOP JUST PRIOR TO DELIVERY); FINISH COAT IN THE FIELD.

PRIME COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.7.

INTERMEDIATE COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.7.

FINISH COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.4 WHEN GREEN COLOR IS SPECIFIED; SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.16 WHEN BLUE COLOR IS SPECIFIED.

PAINT FILM THICKNESS: THE DRY FILM THICKNESS OF THE PAINT AT ANY POINT SHALL NOT BE LESS THAN THE FOLLOWING:

FOR THE PRIME COAT - - - - - 1.7 MILS  
FOR THE INTERMEDIATE COAT- - 1.3 MILS  
FOR THE FINISH COAT- - - - - 1.0 MILS

FOR THE 3 COAT SYSTEM- - - - 4.0 MILS

IF THE REQUIRED PAINT FILM THICKNESS IS NOT ACHIEVED AS SPECIFIED, ADDITIONAL COATS SHALL BE APPLIED UNTIL THE REQUIRED THICKNESS IS OBTAINED.

TOUCH-UP PAINTING: BEFORE APPLICATION OF THE FINISH COATS, THE STEEL SHALL BE TOUCHED UP IN ACCORDANCE WITH THE PROVISIONS OF SSPC-PA 1-64, "SHOP, FIELD, AND MAINTENANCE PAINTING", ESPECIALLY SECTION 3.5.3, "FIELD PAINTING."



COAT OF PAINT

TYPED: ZINC RICH PRIMER, VINYL FINISH COAT.

SURFACE PREPARATION: "WHITE METAL BLAST CLEANING" SSPC-SP5 OR MATCHING ASTM A-133, SA-1, SA-2, SA-3, AND SA-4 FOLLOWED IMMEDIATELY 10 HOURS MAXIMUM BY PRIME COAT.

PAINT APPLICATION: ALL PAINT SHALL BE APPLIED IN ACCORDANCE WITH SSPC-PA 1-1-4 "SURF. FIELD, AND MAINTENANCE PAINTING" AND TO THE FOLLOWING PROVISIONS.

THE PAINT SHALL BE THINNED, USING A POWER AGITATED STIRLER, WITH NOT EXCEEDING ONE VOLUME OF A MIXTURE OF 82% BY VOLUME OF ETHYLENE GLYCOL MONOETHYL ETHER ACETATE AND 18% BY VOLUME TOLUENE TO 4 VOLUMES OF PAINT PRIOR TO USE TO PRODUCE A SMOOTH UNIFORM COATING. AFTER THINNING AND THOROUGH MIXING, THE PRIMER SHALL BE STRAINED THROUGH A 30-60 MESH SCREEN OR DOUBLE LAYER OF CHEESE-CLOTH. THERE SHALL BE NO UNDISPERSED AGGLOMERATES OF ZINC PIGMENT REMAINING IN THE PAINT AFTER MIXING.

AFTER BLAST CLEANING THE ANCHOR PATTERN SHALL BE A MINIMUM OF 1-1/2 MILS DEEP IN A DENSE AND UNIFORM PATTERN OF DEPRESSIONS AND RIDGES.

THE FIRST COAT OF ZINC RICH PRIMER MUST BE APPLIED WITHIN THREE HOURS OF BLAST CLEANING SURFACE.

BLAST CLEANING AND PAINTING WILL NOT BE PERMITTED WHEN THE RELATIVE HUMIDITY EXCEEDS 85% AS MEASURED AT THE SITE OF OPERATIONS.

ALL PAINT SHALL BE APPLIED BY SPRAY METHODS EXCEPT THAT AREAS INACCESSIBLE TO SPRAY APPLICATION SHALL BE BRUSHED. COATED SURFACES WHICH ARE DAMAGED, FAULTY, OR ABRADED, AND ALL EXPOSED UNCOATED SURFACES SHALL BE CLEANED BY SAND-BLASTING AND SPOT PAINTED WITH THIS PRIMER AFTER ERECTION AND BEFORE APPLICATION OF THE SPECIFIED TOP COATS.

FIRST COAT OVER CLEANED STEEL SURFACE SHALL BE TYPE I, RED TINT. SECOND COAT SHALL BE TYPE II, GRAY. IF ADDITIONAL COATS ARE REQUIRED, THEY SHALL BE ALTERNATING TYPE I AND TYPE II. AN AGITATED POT CONTAINING THE PAINT SHALL BE MANDATORY IN ALL SPRAY PAINTING OR BRUSH APPLICATION WORK. THE AGITATOR OR STIRRING ROD SHALL REACH TO WITHIN TWO INCHES OF THE BOTTOM OF THE SPRAY POT AND SHALL BE IN MOTION AT ALL TIMES DURING PAINT APPLICATION. SUCH MOTION SHALL BE SUFFICIENT TO KEEP THE PAINT WELL MIXED. THE PAINT SHALL BE KEPT IN A COOL PLACE.

MAINT. INSTRUCTIONS FOR USE SHALL BE INCLUDED WITH EACH CONTAINER OF PAINT.

WHENEVER PAINTING OPERATIONS ARE INTERRUPTED, THE PAINT SHALL BE KEPT IN THE FLUID STATE BY STIRRING FROM TIME TO TIME. THE PAINT SHALL BE KEPT IN THE FLUID STATE BY STIRRING FROM TIME TO TIME. THE PAINT SHALL BE KEPT IN THE FLUID STATE BY STIRRING FROM TIME TO TIME.

THE APPLICATION OF THE FINISH COATS, EXCEPT FOR THE PRIME COAT, SHALL BE MADE TO THE SURFACE PAINTED WITH VIN-PRIME PRIMER SHALL BE LIMITED TO ONE COAT. THE PRIMER SHALL BE APPLIED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 8.6.21 (MIL. SPEC. 1-15-60). THE PRIMER SHALL BE APPLIED AT LEAST 24 HOURS BEFORE APPLICATION OF THE FINISH COATS. THE VINYL WASH PRIMER SHALL BE APPLIED IN SUCH A MANNER AS TO FORM A FILM AS THE SPRAY CONTACTS THE SURFACE. THE WASH PRIMER SHALL BE APPLIED AT THE RATE OF 100 TO 400 SQUARE FEET PER GALLON OF PRIMER. THE FILM SHALL BE 0.3 TO 0.5 MILS. IT SHALL COMPLETELY AND UNIFORMLY COVER THE UNDERLYING SURFACE.

THE FIRST FINISH COAT SHALL BE APPLIED OVER THE PRIMER WITHIN 72 HOURS OF PRIMER APPLICATION.

NUMBER OF COATS: A MINIMUM NUMBER OF 4 COATS SHALL BE APPLIED: PRIME COAT IN THE SHOP; INTERMEDIATE COAT IN THE SHOP; WASH PRIMER COAT AND FINISH COAT IN THE FIELD.

PRIME COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.21.

INTERMEDIATE COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.21.

WASH PRIMER COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.22.

FINISH COAT: SHALL CONFORM TO THE PROVISIONS OF ARTICLE 8.6.23.

PAINT FILM THICKNESS: THE DRY FILM THICKNESS OF THE PAINT AT ANY POINT SHALL NOT BE LESS THAN THE FOLLOWING:

FOR THE PRIME COAT AND	
FOR THE INTERMEDIATE COAT - - - - -	3.0 MILS TOTAL FOR 2 COATS
FOR THE WASH PRIMER COAT - - - - -	0.3 TO 0.5 MILS
FOR THE FINISH COAT - - - - -	2.0 MILS
FOR THE 4 COAT SYSTEM - - - - -	5.3 MILS

IF THE REQUIRED PAINT FILM THICKNESS IS NOT ACHIEVED AS SET FORTH, ADDITIONAL COATS SHALL BE APPLIED UNTIL THE REQUIRED THICKNESS IS OBTAINED.

TOUCH-UP PAINTING: BEFORE APPLICATION OF THE FINISH COATS, THE TOUCH-UP PAINTING SHALL BE DONE IN ACCORDANCE WITH THE PROVISIONS OF SSPC-PA-1-60, "FIELD PAINTING AND MAINTENANCE PAINTING," ARTICLE 8.5.3, "FIELD PAINTING."



SOLVENT

METHYLENE CHLORIDE  
ASTM 1-740

DRY FILM CHARACTERISTICS

ALL TESTS SHALL BE TESTED IN ACCORDANCE WITH FEDERAL TEST STANDARD NUMBER 1-1.

ADHESION

NOT MORE THAN 10 PERCENT OF THE TOTAL CROSS-HATCHES SHALL FAIL BE CAUSE OF INSUFFICIENT ADHESION.

CHEMICAL RESISTANCE

THE SHOP PRIMER SHALL NOT BE AFFECTED, OTHER THAN DISCOLORATION AFTER EXPOSURE FOR 4 DAYS AT 77 PLUS OR MINUS 5°F. TO:

- (1) 10% SULFURIC ACID SOLUTION
- (2) 10% SODIUM HYDROXIDE SOLUTION
- (3) 10% SODIUM CHLORIDE SOLUTION
- (4) DISTILLED WATER

SALT SPRAY RESISTANCE

THE SHOP PRIMER SHALL SHOW NO DETERIORATION AFTER EXPOSURE TO 5 PERCENT SALT SPRAY SOLUTION FOR 300 HOURS. THE RUST IN THE CROSS SCRIBED AREA SHALL NOT EXCEED 1/16 FROM THE SCRIBE.

ACCELERATED WEATHERING

THE SHOP PRIMER SHALL SHOW NO MORE THAN A NO. 8 CHALK AFTER 300 HOURS EXPOSURE. OTHER THAN COLOR CHANGES, NO VISIBLE DEGRADATION SHALL HAVE OCCURRED.

RECOGNIZABILITY

THIS MATERIAL SHALL NOT BE LIFTED BY A SUCCESSIVE SPECIFIED COATING.





- (C) THE PLASTICIZER SHALL BE MIXED ISOMERS OF TRIPHALATE ESTERS HAVING A MOLECULAR WEIGHT EQUAL TO 446, SPECIFIC GRAVITY EQUAL TO 0.975 AT 20°C, MELTING POINT = 24°C, AND A VISCOSITY AT 20°C OF 113 CENTI-POISE.

#### SOLVENT

MINERAL ETHERAL KETONE,	1	6
ASTM D-740		
CYCLOHEXANONE,	5	20
NYLON,	5	20
ASTM D-364		

#### DRY FILM CHARACTERISTICS

ALL TESTS BELOW SHALL BE CONDUCTED IN ACCORDANCE WITH FEDERAL TEST STANDARD NUMBER 191.

#### FLEXIBILITY

NO FAILURE SHALL BE NOTED WHEN BENT OVER 1/2 INCH MANDREL.

#### ADHESION

NOT MORE THAN 10 PERCENT OF THE TOTAL CROSS-MATCHES SHALL FAIL BECAUSE OF INSUFFICIENT ADHESION.

#### CHEMICAL RESISTANCE

THE SHOP PRIMER SHALL NOT BE AFFECTED, OTHER THAN DISCOLORATION, AFTER EXPOSURE FOR 4 DAYS AT 77 PLUS OR MINUS 5°F. TO:

- (1) 10% SULFURIC ACID SOLUTION
- (2) 10% SODIUM HYDROXIDE SOLUTION
- (3) 10% SODIUM CHLORIDE SOLUTION
- (4) DISTILLED WATER

#### SALT SPRAY RESISTANCE

THE SHOP PRIMER SHALL SHOW NO DETERIORATION AFTER EXPOSURE TO 5 PERCENT SALT SPRAY SOLUTION FOR 100 HOURS. THE RUST IN THE CROSS SCRIBED AREA SHALL NOT EXCEED 1 INCH FROM THE SCRIBE.

#### WATER WEATHERING

THE PRIMER SHALL SHOW NO MORE THAN A NO. 2 GRADE AFTER 300 HOURS OF EXPOSURE. OTHER THAN COLOR CHANGES, NO VISIBLE DEGRADATION SHALL BE NOTED.

THE PRIMER SHALL NOT BE AFFECTED BY A SUNSHINE, WIND, OR RAIN TEST FOR 100 HOURS. THE PRIMER SHALL NOT BE AFFECTED BY A SUNSHINE, WIND, OR RAIN TEST FOR 100 HOURS.

3.1.1. VINYL INTERMEDIATE COAT OR ALTERNATE SHOP PRIMER

THIS SPECIFICATION COVERS AN ALTERNATE VINYL SHOP PRIMER AND INTERMEDIATE FIELD PRIMER FOR APPLICATION TO STEEL, BLAST CLEANED TO A WHITE OR NEAR-WHITE CONDITION IN THE FIELD. IF TINTING IS REQUIRED FOR THE CONTRAST INTERMEDIATE COAT, COMMERCIALY PURE SYNTHETIC IRON OXIDE SHALL BE USED.

PAINT CHARACTERISTICS

		MINIMUM	MAXIMUM
PIGMENT		43	--
VEHICLE	%	--	52
WEIGHT/GALLON	LBS.	11.8	13.0
VISCOSITY	K.U.	70	105
TOTAL SOLIDS	%	58.0	--
WATER	%	--	1.0
DRY TIME, TO TOUCH, MINUTES		--	20
THROUGH, HOURS		4	--

GRIND. METHOD

COMPATIBILITY:

THE PAINT SHALL BE COMPATIBLE SO THAT WHEN ONE PART OF PAINT IS MIXED WITH AN EQUAL PART OF RECOMMENDED SOLVENT, NO CURDLING, LIVERING OR SEPARATING OCCURS.

PIGMENT

BASIC LEAD SILICO CHROMATE,	%	85.0	--
ASTM D-1348			
BARIUM SULFATE, (BARYTES),	%	--	15.0
ASTM D-602			

VEHICLE SOLIDS

TRICRESYL PHOSPHATE,	%	--	15
ASTM D-373			
VINYL RESIN (1),	%	85	--

(1) VINYL RESINS SHALL MEET THE FOLLOWING:

VINYL CHLORIDE	%	90
VINYL ACRYLATE	%	3
VINYL ALCOHOL	%	6
VISCOSITY, DTD BY WEIGHT IN		35 CPS
METHYL ETHYL KETONE		

MINIMUM 100-ETHYL KETONE,	%	60
ASTM D-113		

PIGMENT		
ASTM D-113,	%	40

#### TESTING CHARACTERISTICS

ALL TESTS BELOW SHALL BE CONDUCTED IN ACCORDANCE WITH FEDERAL TEST STANDARD NUMBER 141.

#### ADHESION

NOT MORE THAN 10 PERCENT OF THE TOTAL CROSS-MATCHES SHALL FAIL BECAUSE OF INSUFFICIENT ADHESION.

#### FLEXIBILITY

NO FAILURE SHALL BE NOTED WHEN BENT OVER 1/2 INCH MANDREL.

#### CHEMICAL RESISTANCE

THE SHOP PRIMER SHALL NOT BE AFFECTED, OTHER THAN DISCOLORATION AFTER EXPOSURE FOR 4 DAYS AT 77 PLUS OR MINUS 5°F. TO:

- (1) 10% SULFURIC ACID SOLUTION
- (2) 10% SODIUM HYDROXIDE SOLUTION
- (3) 10% SODIUM CHLORIDE SOLUTION
- (4) DISTILLED WATER

#### SALT SPRAY RESISTANCE

THE SHOP PRIMER SHALL SHOW NO DETERIORATION AFTER EXPOSURE TO 5 PERCENT SPRAY SOLUTION FOR 300 HOURS. THE RUST IN THE CROSS SCRIBED AREA SHALL NOT EXCEED 1/16" FROM THE SCRIBE.

#### ACCELERATED WEATHERING

THE SHOP PRIMER SHALL SHOW NO MORE THAN A NO. 8 CHALK AFTER 300 HOURS EXPOSURE. OTHER THAN COLOR CHANGES, NO VISIBLE DEGRADATION SHALL HAVE OCCURRED.

#### RECOGNIZABILITY

THIS MATERIAL SHALL NOT BE LIFTED BY A SUFFICIENTLY VIOLENT MECHANICAL REQUIREMENTS CITED ELSEWHERE IN THESE SPECIFICATIONS.

# 8.2.2. VINYL FINISH (MT. GREEN AND BLUE)

THIS SPECIFICATION COVERS A VINYL FINISH COAT FOR APPLICATION OVER THE VINYL INTERMEDIATE PRIMER SPECIFIED ELSEWHERE. THE INGREDIENTS TO BE USED IN THIS COAT ARE NOT TOTALLY SPECIFIED; HOWEVER, THE FINISHED PRODUCT SHALL COMPLY WITH ALL REQUIREMENTS CITED HEREIN. THE COMPOSITION FORMULA OF THIS COAT SHALL BE APPROVED BY THE BUREAU OF QUALITY CONTROL PRIOR TO USE.

## PAINT CHARACTERISTICS

		MINIMUM	MAXIMUM
PIGMENT	%	8	--
VEHICLE	%	--	92
WEIGHT/GALLON	LBS.	8.0	10.0
VISCOSITY	K.U.	80	100
TOTAL SOLIDS	%	33	--
WATER	%	--	1.0
DRY TIME, TO TOUCH, MINUTES		--	20
THROUGH, HOURS		--	3
GRIND, HEGMAN		6	--

### COMPATIBILITY:

THE PAINT SHALL BE COMPATIBLE SO THAT WHEN ONE PART OF PAINT IS MIXED WITH AN EQUAL PART OF RECOMMENDED SOLVENT, NO CURDLING, LIVERING OR SEPARATING OCCURS.

### PIGMENT/BINDER:

THE PIGMENT/BINDER RATIO BY WEIGHT SHALL BE 1.0/1.65. THE RATIO BY VOLUME SHALL BE 1.00/5.25.

## PIGMENT

TITANIUM DIOXIDE  
ANTIMONY OXIDE  
PHTHALOCYANINE GREEN AND BLUE

## VEHICLE SOLIDS

VINYL RESIN, (1)	%	85
PHTHALATE PLASTICIZER, (2)	%	15

### (1) VINYL RESIN SHALL MEET THE FOLLOWING:

VINYL CHLORIDE	%	85
VINYL ACETATE	%	15
VISCOSITY, 25°C BY WEIGHT		20 CP
IN MEK		

### (2) THE PLASTICIZER SHALL BE MIXED ISOMERS OF DIALLYL TEREPHTHALATE, 10% OF WHICH SHALL BE DIALLYL TEREPHTHALATE, AND A VISCOSITY OF 10 CP IN MEK.

SOLVENT

METHYL ISO-BUTYL KETONE  
ASTM D-1153

TOLUENE  
ASTM D-362

DRY FILM CHARACTERISTICS

ALL TESTS SHALL BE CONDUCTED IN ACCORDANCE WITH FEDERAL TEST STANDARD  
NUMBER 141.

COLOR

COLOR FOR GREEN FINISH COAT (TOPCOAT) SHALL MATCH THE FEDERAL STANDARD  
595 NUMBER 24172.

COLOR FOR BLUE FINISH COAT (TOPCOAT) SHALL MATCH THE FEDERAL STANDARD  
595 NUMBER 25189.

FLEXIBILITY

NO FAILURE WHEN BENT OVER 1/2 INCH MANDREL.

ADHESION

NO MORE THAN 10 PERCENT OF THE TOTAL CROSS-MATCHES SHALL FAIL BECAUSE  
OF INSUFFICIENT ADHESION.

CHEMICAL RESISTANCE

THE VINYL TOPCOAT SHALL NOT BE AFFECTED, OTHER THAN DISCOLORATION,  
AFTER EXPOSURE FOR 7 DAYS AT 77 PLUS OR MINUS 5°F. TO:

- (1) 10% SULFURIC ACID SOLUTION
- (2) 10% SODIUM HYDROXIDE SOLUTION
- (3) 10% SODIUM CHLORIDE SOLUTION
- (4) DISTILLED WATER

ACCELERATED WEATHERING

THE VINYL TOPCOAT SHALL SHOW NO MORE THAN A NO. 6 CHANGE AFTER 500 HOURS EXPOSURE.  
COLOR CHANGE AFTER 500 HOURS SHALL NOT BE MORE THAN 5 NBS UNITS.

8.1.01 - RING-RICH PRIMER, ORGANIC VEHICLE TYPE

SCOPE: THIS SPECIFICATION COVERS A ONE-PACKAGE, THERMOPLASTIC ORGANIC RICH PRIMER WHOSE MECHANISM OF DRY IS THAT OF SOLVENT RELEASE. IT IS INTENDED FOR USE ONLY ON OPEN STEEL STRUCTURES EXPOSED TO THE AIR. SURFACE PREPARATION OF THE STEEL MUST BE BY BLAST CLEANING AS DESCRIBED HEREIN. IT IS NOT INTENDED FOR USE IN CONFINED SPACES SUCH AS THE INTERIOR OF TANKS, SILOS, OR SIMILAR STRUCTURES BECAUSE OF EXPLOSION AND POSSIBLE TOXIC HAZARDS.

THIS COATING IS INTENDED FOR APPLICATION BY BRUSHING OR SPRAYING EITHER CONVENTIONAL OR AIRLESS. BECAUSE OF RAPID DRYING CHARACTERISTICS, BEST SURFACE APPEARANCE IS OBTAINED BY SPRAY.

APPLICABLE SPECIFICATION: FEDERAL TEST METHOD STANDARD, LATEST REVISION. AMERICAN SOCIETY FOR TESTING AND MATERIALS, LATEST REVISION. MILITARY SPECIFICATION, LATEST REVISION.

MATERIALS: THE RAW MATERIALS FOR USE IN THE PAINT FORMULA SHALL CONFORM TO THE SPECIFICATION DESIGNATED BY FEDERAL SERIAL NUMBER OR PAINT MATERIAL CODE NUMBER HEREINAFTER SPECIFIED. SUBSEQUENT AMENDMENTS TO THE SPECIFICATIONS QUOTED SHALL APPLY TO ALL RAW MATERIALS AND FINISHED PRODUCTS. NO "OR EQUAL" SUBSTITUTION FOR ANY SPECIFIED MATERIAL SHALL BE MADE WITHOUT WRITTEN CONSENT OF THE ENGINEER.

PAINT SHALL BE HOMOGENEOUS, FREE OF CONTAMINANT AND OF A CONSISTENCY SUITABLE FOR USE IN THE CAPACITY FOR WHICH IT IS SPECIFIED. FINISHED PAINT SHALL BE WELL GROUND AND THE PIGMENT SHALL BE PROPERLY DISPERSED IN THE VEHICLE ACCORDING TO THE REQUIREMENTS OF THE PAINT. THE DISPERSION SHALL BE OF SUCH NATURE THAT THE PIGMENT DOES NOT SETTLE RAPIDLY, DOES NOT LAR OR CURDLE. ANY SETTLEMENT OF PIGMENT IN THE PAINT SHALL BE A THOROUGHLY WETTED, SOFT MUSHY MASS PERMITTING THE COMPLETE AND EASY VERTICAL PENETRATION OF A PADDLE. SETTLED PIGMENT SHALL BE EASILY REDISPERSED, WITH MINIMUM RESISTANCE TO THE SIDEWISE MANUAL MOTION OF THE PADDLE ACROSS THE BOTTOM OF THE CONTAINER, TO FORM A SMOOTH UNIFORM PRODUCT OF THE PROPER CONSISTENCY. THE MANUFACTURER SHALL INCLUDE IN THE PAINT THE NECESSARY ADDITIVES FOR CONTROL OF SAGGING, PIGMENT SETTLING, LEVITING, AND OTHER QUALITIES OF A SATISFACTORY WORKING MATERIAL. THE PAINT SHALL POSSESS SATISFACTORY PROPERTIES IN ALL RESPECTS WHICH AFFECT ITS APPLICATION AND CURING.

THERE SHALL BE NO EVIDENCE OF INCOMPATIBILITY WHEN ONE VOLUME OF THE PRIMER DESCRIBED UNDER "APPLICATION OF COATING" IS MIXED WITH FOUR VOLUMES OF THE PAINT.

CHARACTERISTICS OF PAINT

PIGMENT, L BY WEIGHT	80.0 MINIMUM
VEHICLE, L BY WEIGHT	20.0 MAXIMUM
VOLATILES AT 100°C, PERCENT BY WEIGHT	25 - 32
WEIGHT PER GALLON, POUNDS	17.0 - 18.0
VISCOSITY, SAYBOLT	100 - 120

MINIMUM ZINC, PERCENT BY WEIGHT  
OF TOTAL DRY PIGMENT BY FEDERAL  
TEST METHOD N. 141, MINIMUM 90.1

DRY FILM AT 70°F, 50% RELATIVE  
HUMIDITY & MIL WLT THICKNESS:  
SET TO TOUCH, HOURS 3/4 MAX.  
OIL HARD, HOURS 5 MAX.  
STORAGE LIFE, YEARS 1 MIN.

#### PIGMENT COMPOSITION

SPECIFICATION	TYPE I, RED TINT	TYPE II, GRAY
	PARTS BY WT. OF PIGMENT	
ZINC DUST	TT-P-460, TYPE I(1)	95.0 MIN.
RED IRON - OXIDE (2)		1.5 MAX.
ZINC OXIDE	TT-P-463, TYPE I, GRADES A OR B	1.5 MAX.
THINERES & ADDITIVES		3.5 MAX.

(1) EXCEPT THE METALLIC ZINC CONTENT SHALL BE 95 PERCENT BY WEIGHT MINIMUM.

(2) FINENESS, 98.50 MINIMUM; OIL ABSORPTION, 21; FINENESS THROUGH 325 MESH SCREEN, 99% MINIMUM; AND SPECIFIC GRAVITY, 5.15.

THE AVERAGE PARTICLE SIZE OF THE PIGMENT SHALL NOT EXCEED 9 MICRONS AS DETERMINED BY THE FISHER SUB-SIEVE SIZER. THE RED IRON OXIDE MUST FIRST BE GROUND INTO A PORTION OF THE VEHICLE TO PROVIDE A HEGMAN GRIND SUFFICIENT TO PROVIDE THE SPECIFIED COLOR OF THE FINISHED PAINT.

#### VEHICLE COMPOSITION

SPECIFICATION	PARTS OF WEIGHT OF VEHICLE
	14.0
POLYARYL ETHER (3)	
ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE	66.8
TINER	14.2

(3) A POLYARYL ETHER MONOMETHYL POLYETHER OF THE FOLLOWING PROPERTIES:

SPECIFIC GRAVITY	1.15
VISCOSITY OF 4% SOLUTION IN MONOMETHYL ETHER AT 20°C, BROOKFIELD UVE, 10 RPM NO. 5	
1 MINUTE	5500 TO 7700 CP
10 MINUTE	1000 TO 1500 CP
1 HOUR	100 TO 200 CP
1 DAY	5 TO 10 CP
1 MONTH	2 TO 5 CP
1 YEAR	1 TO 2 CP

THE NECESSARY ADDITIVES TO PREVENT CORROSION IN THE CONTAINER ARE  
STANDARD SHOWN IN THE ATTACHED LIST. THE FOLLOWING ARE THE ADDITIVES:

### INFLUENT CHARACTERISTIC CURVE OF TRUCK VEHICLE

WHEN A RED UREA POTASSIUM BENZOATE DISC, A FILM OF THE PRIMER SHALL HAVE INFRARED ANALYSIS MAXIMONS AT THE SAME WAVELENGTHS AND TO THE SAME PERCENTAGE DEGREE AS THAT SHOWN BY THE "INFRARED CURVE OF NEW JERSEY DEPARTMENT OF TRANSPORTATION HIGH PRIMER-VEHICLE SOLIDS". COPIES OF THIS CURVE ARE AVAILABLE UPON REQUEST TO THE NEW JERSEY DEPARTMENT OF TRANSPORTATION, CHIEF, LABORATORY, 100 MARKET STREET, NEWARK, NEW JERSEY.

### PROPERTIES OF CURED COATING

WHEN APPLIED TO A PLATE GLASS PANEL WITH A 6 MIL GAP CLEARANCE DOCTOR BLADE AND CURED FOR 15 DAYS AT 77 PLUS OR MINUS 5°F AND 50 PLUS OR MINUS 5% RELATIVE HUMIDITY; THE COATING SHALL HAVE THE FOLLOWING PROPERTY:

FE'CH: HARDNESS

3 MIN.

WHEN APPLIED BY AIR OR AIRLESS SPRAY TO A MINIMUM DRY FILM THICKNESS OF 1.5 MILS ON SANDBLASTED STEEL HAVING AN ANCHOR PROFILE PATTERN OF ONE TO 1.5 MILS, THE MIXED PAINT SHALL COMPLETELY WET THE SURFACE OF THE STEEL WITH NO EVIDENCE OF DRY SPRAY PARTICLES OR SAGGING.

WHEN APPLIED TO A NET FILM THICKNESS OF 6 MILS ON A METAL PANEL CORRESPONDING TO FEDERAL SPECIFICATION QQ-S-636, THE PANEL BEING PREVIOUSLY CLEANED BY SANDBLASTING TO PRODUCE A ONE TO 1.5 MIL ANCHOR PATTERN, AND CURED FOR 15 DAYS AT A RELATIVE HUMIDITY OF 50 PLUS OR MINUS 5% AND TESTED ACCORDING TO THE CONICAL MANIPUL TEST, FEDERAL TEST METHOD STANDARD NO. 141, METHOD 622, THERE SHALL BE NO LOOSENING OF THE FILM ABOVE THE POINT OF THE LONGEST CONTINUOUS CRACK.

WHEN PANEL IS SANDBLASTED TO WHITE METAL AND COATED WITH 3 TO 4 MILS DRY FILM THICKNESS OF THIS COATING AND CURED FOR 15 DAYS AT 75°F AND 50 PLUS OR MINUS 5% RELATIVE HUMIDITY AND DIAGONALLY SCRIBED TO EXPOSE BARE METAL, THERE SHALL BE NO UNDERFILM CORROSION ON THE SURFACE OF THE PANEL EXTENDING BEYOND THE SCRIBED LINES AFTER 100 HOURS WHEN TESTED ACCORDING TO ASTM METHOD B-117.

[illegible]

MEMPHIS, TENNESSEE AND TAMPA, FLORIDA. THE FBI HAS BEEN ADVISED THAT THE ABOVE NAMED INDIVIDUALS ARE CURRENTLY IN THE AREA OF TAMPA, FLORIDA. THE FBI IS CURRENTLY ATTEMPTING TO LOCATE THEM. THE FBI IS CURRENTLY ATTEMPTING TO LOCATE THEM. THE FBI IS CURRENTLY ATTEMPTING TO LOCATE THEM.



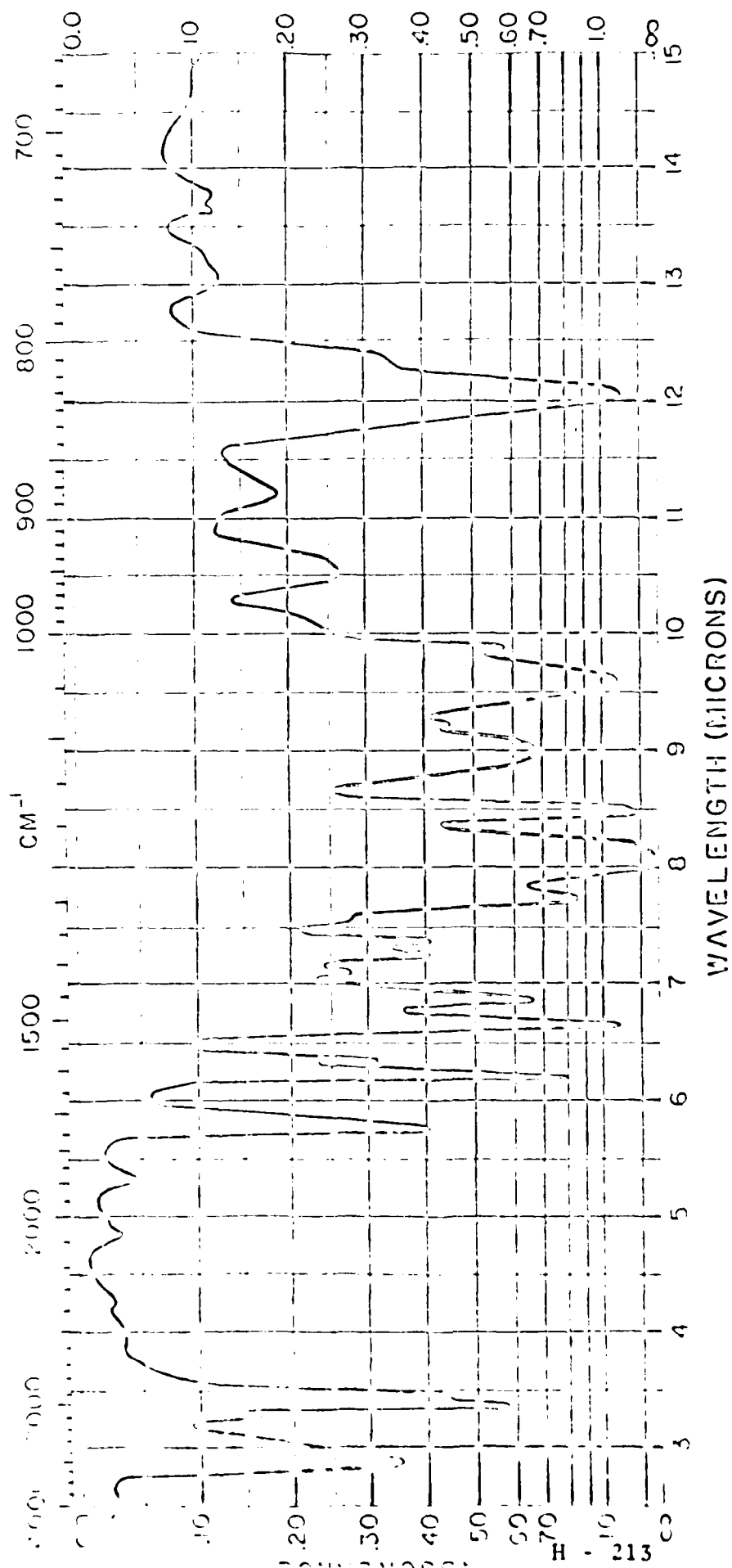
IF NECESSARY, TO AVOID DETACHMENT BY THE PAINT. THE LINING SHALL BE REMOVED FROM THE CAN AT SHIP.

NO FINISHED PAINT SHALL BE USED UNTIL AT LEAST 7 DAYS HAVE ELAPSED FROM THE DATE OF ITS MANUFACTURE.

ALL CONTAINERS OF PAINT SHALL BE LABELED SHOWING THE FLAG, TITLE OF THE SPECIFICATION, STATE SPECIFICATION NUMBER, MANUFACTURER'S NAME, DATE OF MANUFACTURE, STATE LOT NUMBER, AND MANUFACTURER'S BATCH NUMBER.

PRECAUTIONS CONCERNING THE HANDLING AND THE APPLICATION OF PAINT SHALL BE SHOWN ON THE LABEL OF PAINT AND SOLVENT CONTAINERS.

INSPECTION AND TESTING: THIS MATERIAL SHALL BE INSPECTED AND TESTED IN ACCORDANCE WITH NEW JERSEY DEPARTMENT OF TRANSPORTATION STATE SPECIFICATION OR AS OTHERWISE ORDERED NECESSARY. ALL TESTS SHALL BE PERFORMED ACCORDING TO ASTM, FEDERAL TEST METHOD STANDARD NO. 141, OR METHODS DESIGNATED BY THE BUREAU OF QUALITY CONTROL TO INCLUDE INFRARED, CHROMATOGRAPHY AND OTHER INSTRUMENTAL METHODS OF ANALYSIS.



INFRARED CURVE OF N.J.D.O.T. ZINC RICH PRIMER  
VEHICLE SOLIDS

# 5.1.7-1 VINYL WASH PRIMER

THIS SPECIFICATION IS BASED ON MILITARY SPECIFICATION P-15 25 AND 17.1  
BE USED AS A FILM COAT BETWEEN ORGANIC ZINC RICH PRIMER AND A SUBSEQUENT FINISH  
COAT. IT IS ALSO TO BE USED ON FLAT CLEANED STEEL UNDER VINYL PAINT  
FILM.

THE WASH PRIMER IS A TWO COMPONENT SYSTEM AND IS TO MEET THE FOLLOWING  
REQUIREMENTS. THE COMPONENTS SHALL BE MIXED BY VOLUME AS 80% RESIN AND 20%  
ACID SOLUTION OR 4 GALLONS OF RESIN COMPONENT TO 1 GALLON OF ACID COMPONENT.  
THE MIXTURE MUST BE USED WITHIN EIGHT HOURS AFTER MIXING.

## CHARACTERISTICS OF RESIN COMPONENT

		MINIMUM	MAXIMUM
PIGMENT	%	9.5	10.5
VEHICLE	%	80.0	82.0
NON-VOLATILE VEHICLE	%	8.5	9.5
RATIO OF PIGMENT TO BINDER BY WEIGHT		9.7 TO 9	10.3 TO 9
WEIGHT/GALLON	LBS.	7.2	7.7
VISCOSITY	K.U.	57	67
FINENESS, HEGMAN		5	--

## CHARACTERISTICS OF ACID COMPONENT

PHOSPHORIC ACIDS	%	15.0	16.5
WEIGHT/GALLON,	LBS.	7.5	7.9
DISTILLATION:			
INITIAL B. P. °C		75	81
TEMPERATURE AT 105 ML POINT, °C		--	82
VOLUME AT END POINT, ML		120	--
MAXIMUM TEMPERATURE DURING DISTILLATION		--	100

## CHARACTERISTICS OF MIXED RESIN AND ACID COMPONENTS

DRY TIME, HARD 30 MINUTES  
SMOOTH HOMOGENEOUS MIX, NO GELATION WITHIN 24 HOURS IN CLOSED CONTAINER.

## COMPOSITION

### RESIN COMPONENT

### POUNDS/50 GALLONS OF RESIN

EPHALINYL-BUTYL RESIN (1)	50
ETHYL GLYCOLATE (2)	50
METHYLUM SILICONE (MIL M 15173)	8
100% (TTP - 350)	0.1
100% (TTP - 350)	125
100% (TTP - 350)	125

THIS SPECIFICATION CONTAINS ONLY THE MINIMUM REQUIREMENTS FOR THE  
MATERIALS AND THE METHOD OF MIXING. THE METHOD OF MIXING IS TO BE  
DETERMINED BY THE USER.

[illegible][illegible]

THE LABEL SHALL STATE THAT THE PRIMER IS TO BE PACKAGED SUCH THAT THE ACID COMPONENT CAN BE MIXED WITH THE RESIN IN THE RESIN COMPONENT CONTAINER. THE RESIN AND ACID COMPONENTS SHALL BE SEPARATELY PACKAGED, AND THE PACKAGES SHALL BE OF SUCH TYPE AS TO PREVENT ATTACK BY THE COMPONENTS.

THE LATCH SHALL STATE THAT ONE PART BY VOLUME OF THE ACID COMPONENT IS TO BE APPLIED TO ONE PART CONSTANT STIRRING TO FOUR PARTS BY VOLUME OF THE RESIN COMPONENT AND SHOULD USE AND THE MIXED COMPONENTS MUST BE USED WITHIN EIGHT HOURS. IT SHALL FURTHER STATE THAT THE MIXED MATERIAL IS INTENDED FOR SPRAY APPLICATIONS ON SURF THICKNESSES OF 0.3 MIL TO 0.5 MILS.



STATE OF NEW MEXICO  
HIGHWAY DEPARTMENT

BRUCE KING  
GOVERNOR

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Fred L. O'Cheskey

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505 821-4651

District Four Office  
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Las Vegas, NM 87701  
505-425-7527

District Five Office  
P.O. Box 4127-Coronado Sta.  
Santa Fe, NM 87503  
505 983-0221

AN EQUAL  
OPPORTUNITY  
EMPLOYER

October 3, 1979

Fred Ordway  
Executive Vice President  
ARTECH Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

Your letter of September 19, 1979 requesting information regarding the use of zinc-rich paints or primers has been referred to this office by Mr. R. D. Williams.

In New Mexico we have used very little zinc-rich paint or primer. Use is normally limited to touch-up of hot-dipped galvanized products. For this purpose zinc dust-zinc oxide paint conforming to Federal Specification TT-P-641 or MIC-P-21035 is specified.

Very truly yours,

*R. S. Busch*  
R. S. Busch  
Bridge Construction Engineer

RSB:rp

cc: C. E. Serna  
R. D. Williams



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH 27611

JAMES B. HUNT, JR.  
GOVERNOR

THOMAS W. BRADSHAW, JR.  
SECRETARY

DIVISION OF HIGHWAYS

September 27, 1979

Mr. Fred Ordway  
Executive Vice President  
ARTECH CORP.  
2901 Telestar Court  
Falls Church, Virginia 22042

OCT. 1 1979  
4 OCT 8 P.M.

Dear Mr. Ordway:

Attached is a copy of our present specifications for inorganic and organic zinc primers.

This specification is North Carolina's Standard Specification for zinc primer.

If I may be of further assistance, please call on me.

Yours very truly,

  
F. T. Wagner, P. E.  
HEAD OF MATERIALS & TESTS UNIT

FTW/CAC:lh

Attachment

VINYL PAINT SYSTEM FOR STRUCTURAL STEEL:Description

Where a Vinyl Paint System For Structural Steel is called for on the plans, painting shall be in accordance with Section 442 of the 1978 Standard Specifications, except as modified herein. This work shall consist of surface preparation and painting of metal surfaces. All paint in this paint system shall be applied by spraying, except that minor repairs to the primer may be made by brush where permitted by the Engineer. The paint system shall conform to either ALTERNATE A or ALTERNATE B.

ALTERNATE A

		<u>Minimum dry film thickness (mils)</u>
Primer	Inorganic Zinc Silicate	3.0
Wash Primer	MIL-P-15328B	0.3
Finish Paint	Vinyl	3.0

ALTERNATE B

		<u>Minimum dry film thickness (mils)</u>
Primer	Organic Zinc-Rich	3.0
Wash Primer	MIL-P-15328B	0.3
Finish Paint	Vinyl	3.0

Continued on Next Sheet

### Materials

Primer paint shall conform to the attached special provisions for Inorganic Zinc Silicate Primer or Organic Zinc-Rich Primer. Wash primer shall conform to MIL-P-15328B. Finish paint shall conform to the attached special provisions for Vinyl Finish Paint.

### Sampling and Testing

Initial paint samples and certified test reports of the zinc primer, wash primer and vinyl finish paint shall be submitted by the manufacturer of the paint materials to the Head of Materials and Tests Unit for qualification at least 30 days in advance of anticipated need. After qualification, additional samples taken by an approved representative of the Department of Transportation, shall be required from each batch but additional certified test reports shall not be required.

All samples shall be a minimum of one quart identified with the manufacturer's name, batch number, brand name, location and date of manufacture. The certified test report for the chemical and performance requirements shall conform to a Type 4 certification as specified in Article 106-3 of the 1978 Standard Specifications except that it shall be for the same lot as the sample submitted for qualification.

New certified test results and qualification samples shall be submitted when the manufacturing process or paint formulation is changed, or when required by the Materials and Tests Unit.

All tests of paints will be conducted in accordance with the latest test methods of the American Society for Testing and Materials, Federal Test Method Standard No. 141, and methods in use by the Materials and Tests Unit.

### Preparation of Surfaces

Metal surfaces to which primer is to be applied shall be prepared by near white blast cleaning in accordance with Subarticle 442-8(A) of the 1978 Standard Specifications, except for shear connectors and the top surface of beam or girder flanges to be encased in concrete. Hand or power tool cleaning, in accordance with Subarticle 442-8(B) of the 1978 Standard Specifications, will be acceptable on these surfaces.

Photographic standard of comparison shall be used to define the final surface condition to be supplied. For steel surface covered completely with adherent mill scale, for partially rusted mill scale, or for completely rusted mill scale, the appearance of the surface after blast cleaning shall correspond with pictorial standards A Sa 2 1/2, B Sa 2 1/2, or C Sa 2 1/2 of SSPC-Vis 1. The profile of 1 to 2.5 mils shall be angular.

With the sole exception of edges at surfaces which bear on other surfaces, all sharp edges and ends of shapes and plates, shall be slightly rounded by suitable means to a radius of approximately 1/16 inch or equivalent flat surface at a suitable angle. This rounding of edges shall be paid for in the contract lump sum price for "Structural Steel".



### Mixing and Application of Paint

The inorganic zinc silicate is a two-component system and shall be mixed and applied in strict accordance with the manufacturer's instructions. The organic zinc-rich primer shall be ready-mixed when delivered and applied in strict accordance with the manufacturer's instructions. The wash primer is a two-component system and shall be mixed just prior to use. The vinyl finish paint shall be ready-mixed when delivered and applied in strict accordance with the manufacturer's instructions.

The entire paint system shall be manufactured by the same paint manufacturer. Should the paint manufacturer demonstrate by past performance that the primer and finish paint are compatible and that use of a washcoat is not needed, the Engineer may waive the requirement of a wash primer.

Application of the paint shall not be started until after the paint materials have been approved by the Materials and Tests Unit.

The Inorganic Zinc Silicate Primer and the Wash Primer are two-component materials having a limited pot life after mixing. The manufacturer's recommendations shall be followed for the useful pot life of these materials after mixing.

Where thinning of the material is required, only material compatible with the base material and recommended by the manufacturer shall be used, and then only to the extent permitted in the application instructions. In the absence of any specific requirements herein, the manufacturer's application instructions shall govern.

Paint shall be done in a neat and workmanlike manner. The paint shall be applied in such a manner as to provide a tight film of the specified thickness, well bonded to the metal or previously applied paint and worked into all crevices and corners, providing ample coverage, free from laps, streaks, sags or other defects.

Use of an agitated spray pot shall be mandatory in all spray painting of the paint system. The agitator or stirring rod shall reach to within 2 inches of the bottom of the spray pot and shall be in motion at all times during paint application. Such motion shall be sufficient to keep the paint well mixed.

### Shop Painting

Shop painting is the painting of structural steel in a shop or plant before shipment to the site of erection. Shop painting shall consist of painting with a primer, wash primer and finish paint over all metal surfaces except where otherwise provided by these special provisions.

All shop fabrication, including welding and attachment of shear connectors, shall be complete before painting is started.

After shop fabrication and surface preparation is complete, the primer shall be applied to all surfaces, except splice plate surfaces and contact surfaces within bolted beam and girder splices. The primer shall be applied on the same day that blast cleaning is done.

### 8.18 4801

After the primer has dried throughout the full thickness of the paint film, the wash primer shall be applied to all surfaces that are to receive the shop finish paint. Not more than 48 hours shall elapse between application of the wash primer and application of the finish paint.

After the wash primer has dried, the finish paint shall be applied in the shop to all surfaces except:

1. Top of flanges to be cast in contact with concrete.
2. Shear connectors.
3. Areas where field welding will be performed.
4. Outside surfaces of splice plates.
5. Contact surfaces in all bolted connections, including beam and girder splices.

The finish paint shall extend no closer than 2 inches nor more than 3 inches from the point at which the primer is terminated at areas left unpainted due to splices. Primer paint shall be clearly visible around these areas. The same offset dimensions will be required for finish paint at field welds, measured from the proposed location of the field weld.

The finish paint shall be required under the head and nut of galvanized high strength bolts.

#### Field Welds

The shop primer paint, at the location of field welds, shall be satisfactorily removed by blast cleaning, flame cleaning or hand or power tool cleaning just prior to performing the welding. Cleaning shall be sufficient to prevent contamination of the weld by the paint.

#### Handling, Storing and Erection of Structural Steel

In addition to the requirements of Article 440-4 of the 1978 Standard Specifications, structural steel members shall be handled, stored and erected in such a manner that will prevent damage to the metal and painted surfaces. Special care shall be exercised in installing high strength bolts so as not to scar the shop painted surfaces.

#### Field Painting

Field painting shall consist of painting with a primer, wash primer and finish paint over all metal surfaces not previously painted in the shop and over all previously painted surfaces which have been damaged, and painting with wash primer and finish paint over metal surfaces which have been painted in the shop with primer paint only. An additional appearance coat shall be applied in the field to the outside face of all exterior beams or girders.

Immediately after steel erection on a structure is complete, and in all cases

before forming adjacent concrete or casting any deck concrete, all field weld slag and spatter, and damaged prime paint on both sides of zones heated by welding shall be removed and unpainted surfaces shall be thoroughly cleaned and prepared by near white blast cleaning. These surfaces shall be touch-up primed as specified for the shop primer on the same day that blast cleaning is done. The field primer shall have a minimum dry film thickness of 3 mils. Overlap of the field primer onto the shop finish paint will not be permitted.

Except for surfaces on field splices, field painting will not be required on surfaces to be encased in concrete.

After the concrete work is complete and all forms removed, the steel shall be thoroughly cleaned in accordance with Subarticle 442-8(B) of the 1978 Standard Specifications. All surfaces from which the shop coats or field primer has been worn or damaged shall be repaired as directed by the Engineer. Not more than 48 hours shall elapse between applications of the wash primer and application of the finish paint.

After all repair paint is complete and has dried, an appearance coat of the vinyl finish paint shall be applied to the outside face of all exterior beams or girders with a thickness sufficient to provide a uniform appearance after drying. Just prior to applying the appearance coat, all surfaces to receive this coat shall be cleaned or prepared in accordance with the paint manufacturer's recommendations. All shipping marks, erection marks, and weight marks shall be thoroughly covered with one coat of the vinyl finish paint.

The portion of galvanized high strength bolts on the outside face of exterior beams or girders shall be painted with the wash primer and appearance coat of the vinyl finish paint. The wash primer shall be applied to the galvanized high strength bolts by brush with care being taken not to apply the wash primer to the adjacent finish paint.

#### Inorganic Zinc Silicate Primer:

This special provision covers a 2-component self-curing partially hydrolyzed ethyl silicate vehicle type zinc silicate paint which shall cure without the use of a separate curing solution.

Paint shall be homogenous, free of contaminants and of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing.

6.07 Composition(a) Pigment

## COMPONENT A

The zinc used in the pigment shall be zinc dust, Type 1, Regular, meeting the requirements of Federal Specification TT-P-460. All other fillers contained in the pigment shall be inert substances.

(b) Vehicle

## COMPONENT B

## PARTIALLY HYDROLYZED ETHYL SILICATE VEHICLE

The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent. The ethyl silicate used in the hydrolysis reaction in the preparation of the vehicle shall contain at least 28 percent silicon dioxide.

(c) Vehicle Properties

Nonvolatile at 105° C percent by weight, minimum	37
SiO <sub>2</sub> percent by weight of vehicle (without pigments), minimum	9.0
Storage life of vehicle at 77° F, months, minimum	12
Weight per gallon, pounds, at 77° F, minimum	8.8

(d) Properties of Mixed Paint

Weight per gallon, pounds, minimum	20.5
Viscosity, K.U. at 77° F	60-100
Nonvolatile at 105° C percent by weight, minimum	70
Set to touch at 77° F, minutes, maximum	30
Dry hard at 77° F, hours, maximum	24
Pot life at 77° F, minimum, hours	8

The mixed paint shall have a zinc content of not less than 75 percent by weight of the total nonvolatile content. Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating.

Performance Requirements

Test panels of steel meeting the requirements of ASTM D 609-61 having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to meet Steel Structures Painting Council Specification, SSPC-SP 10-63. The blast cleaned surfaces shall have a nominal height of profile of 1 to 2.5 mils.

8.18:4801

A three mil coating (dry thickness) shall be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

(a) Fresh Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and shall be immersed in fresh tap water at 75° F+ 5° F. The panels shall show no rusting, blistering or softening when examined after 30 days.

(b) Salt Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and immersed in a 5 percent sodium chloride solution at 75° F+ 5° F. The panels shall show no rusting, blistering or softening upon examination after 7, 14 and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

(c) Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours of continuous exposure, the coating shall show no rusting or loss of adhesion to the steel test panel or blistering.

(d) Salt Fog Resistance

Panels shall be scribed with an x of at least 2 inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

Color

The Inorganic Zinc Silicate Primer shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish paint.

Application

The manufacturer's current printed instructions for application of Inorganic Zinc Silicate Primer shall be submitted to the Materials and Tests Unit for review.

Organic Zinc-Rich Primer:

This special provision covers a one-package, thermoplastic organic zinc-rich primer whose mechanism of drying is that of solvent release.

Paint shall be homogeneous, free of contaminants and of a consistency suitable

for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing.

### Composition

#### (a) Pigment

The zinc used in the pigment shall be zinc dust, Type I, Regular, meeting the requirements of Federal Specification TT-P-460.

#### (b) Vehicle

The vehicle shall consist primarily of Polyaryl Ether dissolved in appropriate solvents. The Polyaryl Ether shall be a polyhydroxy polyalkaryl polyether of the following properties:

Specific gravity	1.18
Viscosity of 40% solids in methyl ethyl ketone, Brookfield RVF, 20 rpm No. 5 spindle	5,500 to 7,700 cps
Reduced viscosity (0.2 g/100 ml. dimethylformamide)	0.4 to 0.6
Ultimate tensile strength	9,000 to 9,500
Ultimate tensile elongation	50 to 100%
Softening temperature	212°F.
Bulking value	9.83 lbs. per gal.

#### (c) Properties of Mixed Paint

Weight per gallon, pounds, minimum	17.2
Nonvolatiles at 105° C, percent by weight, minimum	68
Viscosity, K.U. at 77° F	90-120
Set to touch at 77° F, minutes, maximum	45
Dry hard at 77° F, hours, maximum	5
Storage life, months, minimum	12

The mixed paint shall have a zinc content of not less than 80 percent by weight of the total nonvolatile content. Working properties shall

be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating. The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

#### Performance Requirements

Test panels of steel meeting the requirements of ASTM D 609-61 having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to meet Steel Structures Painting Council Specification, SSPC-SP 10-63. The blast cleaned surfaces shall have a nominal height of profile of 1 to 2.5 mils. A three mil coating (dry thickness) shall be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

##### (a) Fresh Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening when examined after 30 days.

##### (b) Salt Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and immersed in a 5 percent sodium chloride solution at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening upon examination after 7, 14 and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

##### (c) Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours of continuous exposure, the coating shall show no rusting or loss of adhesion to the steel test panel or blistering.

##### (d) Salt Fog Resistance

Panels shall be scribed with an x of at least 2 inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

#### Color

The Organic Zinc-Rich Primer shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish paint.

Application

The manufacturer's current printed instructions for application of Organic Zinc-Rich Primer shall be submitted to the Materials and Tests Unit for review.

Vinyl Finish Paint:

This special provision covers a ready-mixed vinyl finish paint of the air-drying type.

Paint shall be homogeneous, free of contaminants and of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing. The paint shall contain less than 0.5% lead by weight.

Composition(a) Pigments

The pigment shall consist essentially of Titanium Dioxide, Phthalocyanine Green, and Chrome Oxide Green. All pigment components, including any tinting or extender pigments, shall be chemically pure, non-reactive and color permanent. Pigments shall be blended so as to obtain a proper color match.

(b) Vehicle

The vehicle shall consist essentially of vinyl resins dissolved in appropriate solvents. A primary ingredient shall be vinyl chloride-vinyl acetate maleic acid tripolymer resin. The remainder of the resin shall be vinyl chloride-vinyl acetate copolymer or partially hydrolyzed copolymer.

(c) Properties of Mixed Paint

Weight per gallon, pounds, minimum	8.0
Viscosity, K.U. at 77° F	60-100
Nonvolatile, percent by weight, minimum	35.0
Pigment content, percent by weight, minimum	12.0
Water, percent by weight, maximum	1.0



Coarse particles and skins as residue retained on Standard 325 mesh screen, percent by weight, maximum	1.0
Fineness of grind, Hegman Units, minimum	6.0
Set to touch at 77° F, minutes, maximum	30
Dry for recoating at 77° F, hours, maximum	3

Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength. Other ingredients, such as antigelling agents, which may be necessary to meet all of the requirements of these special provisions, may be included. The preparation of this paint in steel ball mills is not acceptable.

#### Performance Requirements

Test panels shall be prepared from new cold-rolled steel, rust free No. 20 gage (0.0375 inches) meeting the requirements of Federal Specification QQ-S-698 for cold-rolled carbon steel strip. The test panels having dimensions of 2 inches by 5 inches, shall be used in the chemical resistance, flexibility and salt spray resistance tests. The test panels shall be blast cleaned to meet Steel Structures Painting Council Specification, SSPC-SP 10-63 with a nominal height of profile of 1 to 2.5 mils. A three mil coating (dry thickness) shall be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer.

The following tests shall be performed. Failure of the paint to conform to any of the requirements of the following tests, shall be cause for rejection of the paint.

#### (a) Chemical Resistance

The vinyl finish paint shall show no visual deterioration, other than minor discolorations, after seven days exposure to:

- (1) 10 percent sulfuric acid solution
- (2) 10 percent sodium hydroxide solution
- (3) 10 percent sodium chloride solution
- (4) Distilled water

#### (b) Flexibility

The vinyl finish paint shall show no cracking or loss of adhesion or cohesion when the coated panel is bent 180° around a 1-inch mandrel with the coating on the tension side. The bending test shall be made at 73° ± 2° F.

#### (c) Salt Spray Resistance

The vinyl finish paint shall show no softening, blistering, embrittlement or loss of adhesion after removal from 275 hours of exposure to salt spray. The salt spray test shall be conducted in accordance with the requirements of Federal Test Method Standard No. 1.

(d) Compatability

50 cc of paint shall be able to be mixed with 50 cc of the manufacturer's recommended thinner without curdling, livering, separating or otherwise affecting the paint except to thin it.

26.16

Application Properties

The paint shall be a freely working product with good leveling properties. Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating. The paint, when applied as recommended by the manufacturer, shall lay up in a uniform wet film, free from seeds, striations, craters, pinholes, runs or sags. The sprayed paint film shall exhibit uniform color and appearance.

The manufacturer's current printed instructions for application of Vinyl Finish Paint shall be submitted to the Materials and Tests Unit for review.

26.17

Color

The vinyl finish paint shall be green, matching color No. 24272 of Federal Standard No. 595. Specific dry-film color match will be required.

NEW YORK STATE  
DEPARTMENT OF TRANSPORTATION  
William C. Hennessy, Commissioner



1220 Washington Avenue, State Campus, Albany, New York 12232

October 29, 1979

1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, VA 22042

Dear Mr. Ordway:

In reply to your letter of September 19, this is to advise you that our Department does not normally specify zinc-rich paints or primers for our protective coating work. If a situation occurred where we felt that a zinc-rich paint system would be beneficial we would probably reference our requirements to a Federal or SSPC Specification.

Very truly yours,

A handwritten signature in cursive script, appearing to read "James J. Murphy".

James J. Murphy, P.E.  
Director, Materials Bureau

DRB:js  
File: 8.1  
M920

DEPARTMENT OF TRANSPORTATION

ROUTE SLIP

DATE 3/20/79

TO:	NAME	ORG RTG SYMBOL
	Mr. R. E. Hay, Chief	HRS-23
	Materials Division	
	Office of Research	
	Attention: Dr. B. R. Appleman	

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> PER YOUR REQUEST     | <input type="checkbox"/> FOR YOUR SIGNATURE          |
| <input checked="" type="checkbox"/> FOR YOUR INFORMATION | <input type="checkbox"/> COMMENT                     |
| <input type="checkbox"/> PER OUR CONVERSATION            | <input type="checkbox"/> TAKE APPROPRIATE ACTION     |
| <input type="checkbox"/> NOTE AND RETURN                 | <input type="checkbox"/> PLEASE ANSWER               |
| <input type="checkbox"/> DISCUSS WITH ME                 | <input type="checkbox"/> PREPARE REPLY FOR SIGNATURE |
| <input type="checkbox"/> FOR YOUR APPROVAL               | OF   |

REMARKS:

Re: North Carolina - Use of shop-applied structural steel painting system.

14 OCT 1979

FROM: J. D. Lacy Regional Federal Hwy. Administrator	TELEPHONE NO 257-4167	ORG RTG SYMBOL HBR-04
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FORM DOT F 1320.9 (3-67) FORMERLY FORM OST F 1320.1

## DEPARTMENT OF TRANSPORTATION

## ROUTE SLIP

DATE

2-15-70

TO:

NAME

ORG RTG SYMBOL

Mr. James D. Lacy

HPR-04

Regional Federal Highway Administrator

Atlanta, Georgia

☒ PER YOUR REQUEST☒ FOR YOUR INFORMATION☐ PER OUR CONVERSATION☐ NOTE AND RETURN☐ DISCUSS WITH ME☐ FOR YOUR APPROVAL☐ FOR YOUR SIGNATURE☐ COMMENT☐ TAKE APPROPRIATE ACTION☐ PLEASE ANSWER☐ PREPARE REPLY FOR SIGNATURE

OF \_\_\_\_\_

## REMARKS:

Re: Shop Applied Paint

Mrs. Walker passed your message on to me. Attached are (2) copies of N. C. Paint System 4, Shop applied.

Be advised however that most of our recent steel girders have been in A 588, unpainted.

FHWA R-4	Reg. Adm.	Dep. Reg. Adm.	Admin.	Audit	Civil Rights	Legal	Public	C & M	Env. & Design	MCS	Pl. & Prog.	R. C. W.	File

FROM:

*Ronald E. Heinz*  
FOR RONALD E. HEINZ  
DIVISION ADMINISTRATOR

TELEPHONE NO

755-4270

ORG RTG SYMBOL

HPR-NC

FORM DOT F 1320 9 (5-67) FORMERLY FORM OST F 1320 1

5.1555304

RF 45-1(25)

Montgomery Co.

RECEIVED  
REG. 4 F.H.W.A.

N.C

MAR 19 1979

PAINT SYSTEM 4 FOR PAINTING STRUCTURAL STEEL

Description

Where Paint System 4 is called for on the plans, painting shall be in accordance with Section 442 of the 1972 Standard Specifications, except as modified herein. This work shall consist of surface preparation and painting of metal surfaces. All paint in this paint system shall be applied by spraying, except that minor repairs to the primer may be made by brush where permitted by the Engineer. The paint system shall conform to either ALTERNATE A or ALTERNATE B.

ALTERNATE A

		Minimum dry film thickness (mils)
Primer	Inorganic Zinc Silicate	3.0
Wash Primer	MIL-P-15328B	0.3
Finish Paint	Vinyl	3.0

ALTERNATE B

		Minimum dry film thickness (mils)
Primer	Organic Zinc-Rich	3.0
Wash Primer	MIL-P-15328B	0.3
Finish Paint	Vinyl	3.0

Materials

Primer paint shall conform to the attached special provisions for Inorganic Zinc Silicate Primer or Organic Zinc-Rich Primer. Wash primer shall conform to MIL-P-15328B. Finish paint shall conform to the attached special provisions for Vinyl Finish Paint.

Sampling and Testing

Initial paint samples and certified test reports of the zinc primer, wash primer and vinyl finish paint shall be submitted by the manufacturer of the paint materials to the Head of Materials and Tests Unit for qualification at least 30 days in advance of anticipated need. After qualification, additional samples taken by an approved representative of the Department of Transportation, shall be required from each batch but additional certified test reports shall not be required.

All samples shall be a minimum of one quart identified with the manufacturer's name, batch number, brand name, location and date of manufacture. The certified test report for the chemical and performance requirements shall conform to a Type 4 certification as specified in Article 106-3 of the 1972 Standard Specifications except that it shall be for the same lot as the sample submitted for qualification.

New certified test results and qualification samples shall be submitted when the manufacturing process or paint formulation is changed, or when required by the Materials and Tests Unit.

All tests of paints will be conducted in accordance with the latest test methods of the American Society for Testing and Materials, Federal Test Method Standard No. 141, and methods in use by the Materials and Tests Unit.

#### Preparation of Surfaces

Metal surfaces to which primer is to be applied shall be prepared by near white blast cleaning in accordance with Subarticle 442-8(A) of the 1972 Standard Specifications, except for shear connectors and the top surface of beam or girder flanges to be encased in concrete. Hand or power tool cleaning, in accordance with Subarticle 442-8(B) of the 1972 Standard Specifications, will be acceptable on these surfaces.

Photographic standard of comparison shall be used to define the final surface condition to be supplied. For steel surface covered completely with adherent mill scale, for partially rusted mill scale, or for completely rusted mill scale, the appearance of the surface after blast cleaning shall correspond with pictorial standards A Sa 2½, B Sa 2½, or C Sa 2½ of SSPC-Vis 1. The profile of 1 to 2.5 mils shall be angular.

With the sole exception of edges at surfaces which bear on other surfaces, all sharp edges and ends of shapes and plates, shall be slightly rounded by suitable means to a radius of approximately 1/16 inch or equivalent flat surface at a suitable angle. This rounding of edges shall be paid for in the contract lump sum price for "Structural Steel".

### Mixing and Application of Paint

The inorganic zinc silicate is a two-component system and shall be mixed and applied in strict accordance with the manufacturer's instructions. The organic zinc-rich primer shall be ready-mixed when delivered and applied in strict accordance with the manufacturer's instructions. The wash primer is a two-component system and shall be mixed just prior to use. The vinyl finish paint shall be ready-mixed when delivered and applied in strict accordance with the manufacturer's instructions.

The entire paint system shall be manufactured by the same paint manufacturer. Should the paint manufacturer demonstrate by past performance that the primer and finish paint are compatible and that use of a washcoat is not needed, the Engineer may waive the requirement of a wash primer.

Application of the paint shall not be started until after the paint materials have been approved by the Materials and Tests Unit.

The Inorganic Zinc Silicate Primer and the Wash Primer are two-component materials having a limited pot life after mixing. The manufacturer's recommendations shall be followed for the useful pot life of these materials after mixing.

Where thinning of the material is required, only material compatible with the base material and recommended by the manufacturer shall be used, and then only to the extent permitted in the application instructions. In the absence of any specific requirements herein, the manufacturer's application instructions shall govern.

Painting shall be done in a neat and workmanlike manner. The paint shall be applied in such a manner as to provide a tight film of the specified thickness, well bonded to the metal or previously applied paint and worked into all crevices and corners, providing ample coverage, free from laps, streaks, sags or other defects.

Use of an agitated spray pot shall be mandatory in all spray painting of the paint system. The agitator or stirring rod shall reach to within 2 inches of the bottom of the spray pot and shall be in motion at all times during paint application. Such motion shall be sufficient to keep the paint well mixed.



### Shop Painting

Shop painting is the painting of structural steel in a shop or plant before shipment to the site of erection. Shop painting shall consist of painting with a primer, wash primer and finish paint over all metal surfaces except where otherwise provided by these special provisions.

All shop fabrication, including welding and attachment of shear connectors, shall be complete before painting is started.

After shop fabrication and surface preparation is complete, the primer shall be applied to all surfaces, except splice plate surfaces and contact surfaces within bolted beam and girder splices. The primer shall be applied on the same day that blast cleaning is done.

After the primer has dried throughout the full thickness of the paint film, the wash primer shall be applied to all surfaces that are to receive the shop finish paint. Not more than 48 hours shall elapse between application of the wash primer and application of the finish paint.

After the wash primer has dried, the finish paint shall be applied in the shop to all surfaces except:

1. Top of flanges to be cast in contact with concrete.
2. Shear connectors.
3. Areas where field welding will be performed.
4. Outside surfaces of splice plates.
5. Contact surfaces in all bolted connections, including beam and girder splices.

The finish paint shall extend no closer than 2 inches nor more than 3 inches from the point at which the primer is terminated at areas left unpainted due to splices. Primer paint shall be clearly visible around these areas. The same offset dimensions will be required for finish paint at field welds, measured from the proposed location of the field weld.

The finish paint shall be required under the head and nut of galvanized high strength bolts.

### Field Welds

The shop primer paint, at the location of field welds, shall be satisfactorily removed by blast cleaning, flame cleaning or hand or power tool cleaning just prior to performing the welding. Cleaning shall be sufficient to prevent contamination of the weld by the paint.

### Handling, Storing and Erection of Structural Steel

In addition to the requirements of Article 440-4 of the 1972 Standard Specifications, structural steel members shall be handled, stored and erected in such a manner that will prevent damage to the metal and painted surfaces. Special care shall be exercised in installing high strength bolts so as not to scar the shop painted surfaces.

### Field Painting

Field painting shall consist of painting with a primer, wash primer and finish paint over all metal surfaces not previously painted in the shop and over all previously painted surfaces which have been damaged, and painting with wash primer and finish paint over metal surfaces which have been painted in the shop with primer paint only. An additional appearance coat shall be applied in the field to the outside face of all exterior beams or girders.

As soon as practical after steel erection on a structure is complete, and in all cases before forming adjacent concrete or casting any deck concrete, all field weld slag and spatter, and damaged prime paint on both sides of zones heated by welding shall be removed and unpainted surfaces shall be thoroughly cleaned and prepared by near white blast cleaning. These surfaces shall be touch-up primed as specified for the shop primer on the same day that blast cleaning is done. The field primer shall have a minimum dry film thickness of 3 mils. Overlap of the field primer onto the shop finish paint will not be permitted.

Surfaces to be encased in concrete shall not be field painted.

After the concrete work is complete and all forms removed, the steel shall be thoroughly cleaned in accordance with Subarticle 442-8(B) of the 1972 Standard Specifications. All surfaces from which the shop coats or field primer has been worn or damaged shall be repaired as directed by the Engineer. Not more than 48 hours shall elapse between application of the wash primer and application of the finish paint.

After all repair painting is complete and has dried, an appearance coat of the vinyl finish paint shall be applied to the outside face of all exterior beams or girders with a thickness sufficient to provide a uniform appearance after drying. Just prior to applying the appearance coat, all surfaces to receive this coat shall be cleaned or prepared in accordance with the paint manufacturer's recommendations. All shipping marks, erection marks, and weight marks shall be thoroughly covered with one coat of the vinyl finish paint.

The portion of galvanized high strength bolts on the outside face of exterior beams or girders shall be painted with the wash primer and appearance coat of the vinyl finish paint. The wash primer shall be applied to the galvanized high strength bolts by brush with care being taken not to apply the wash primer to the adjacent finish paint.

#### INORGANIC ZINC SILICATE PRIMER

##### Description

This special provision covers a 2-component self-curing partially hydrolyzed ethyl silicate vehicle type zinc silicate paint which shall cure without the use of a separate curing solution.

Paint shall be homogenous, free of contaminants and of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing.

Composition

(a) Pigment

COMPONENT A

The zinc used in the pigment shall be zinc dust, Type I, Regular, meeting the requirements of Federal Specification TT-P-460. All other fillers contained in the pigment shall be inert substances.

(b) Vehicle

COMPONENT B

PARTIALLY HYDROLYZED ETHYL SILICATE VEHICLE

The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent. The ethyl silicate used in the hydrolysis reaction in the preparation of the vehicle shall contain at least 28 percent silicon dioxide.

(c) Vehicle Properties

Nonvolatile at 105° C percent by weight, minimum	37
SiO <sub>2</sub> percent by weight of vehicle (without pigments), minimum	9.0
Storage life of vehicle at 77° F, months, minimum	12
Weight per gallon, pounds, at 77° F, minimum	8.8

(d) Properties of Mixed Paint

Weight per gallon, pounds, minimum	20.5
Viscosity, K.U. at 77° F	60-100
Nonvolatile at 105° C percent by weight, minimum	70
Set to touch at 77° F, minutes, maximum	30
Dry hard at 77° F, hours, maximum	24
Pot life at 77° F, minimum, hours	8

The mixed paint shall have a zinc content of not less than 75 percent by weight of the total nonvolatile content. Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating.

Performance Requirements

Test panels of steel meeting the requirements of ASTM D 609-61 having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to meet Steel Structures Painting Council Specification, SSPC-SP 10-63. The blast cleaned surfaces shall have a nominal height of profile of 1 to 2.5 mils. A three mil coating (dry thickness) shall be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

(a) Fresh Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and shall be immersed in fresh tap water at 75° F ± 5° F. The panels shall show no rusting, blistering or softening when examined after 30 days.

(b) Salt Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and immersed in a 5 percent sodium chloride solution at 75° F ± 5° F. The panels shall show no rusting, blistering or softening upon examination after 7, 14 and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

(c) Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours of continuous exposure, the coating shall show no rusting or loss of adhesion to the steel test panel or blistering.

(d) Salt Fog Resistance

Panels shall be scribed with an x of at least 2 inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

Color

The Inorganic Zinc Silicate Primer shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish paint.

Application

The manufacturer's current printed instructions for application of Inorganic Zinc Silicate Primer shall be submitted to the Materials and Tests Unit for review.

ORGANIC ZINC-RICH PRIMER

Description

This special provision covers a one-package, thermoplastic organic zinc-rich primer whose mechanism of drying is that of solvent release.

Paint shall be homogenous, free of contaminants and of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing.

Composition

(a) Pigment

The zinc used in the pigment shall be zinc dust, Type I, Regular, meeting the requirements of Federal Specification TT-P-460.

(b) Vehicle

The vehicle shall consist primarily of Polyaryl Ether dissolved in appropriate solvents. The Polyaryl Ether shall be a polyhydroxy polyalkaryl polyether of the following properties:

Specific gravity	1.18
Viscosity of 40% solids in methyl ethyl ketone, Brookfield RVF, 20 rpm No. 5 spindle	5,500 to 7,700 cps
Reduced viscosity (0.2 g/100 ml. dimethylformamide)	0.4 to 0.6
Ultimate tensile strength	9,000 to 9,500
Ultimate tensile elongation	50 to 100%
Softening temperature	212°F.
Bulking value	9.83 lbs. per gal.

(c) Properties of Mixed Paint

Weight per gallon, pounds, minimum	17.2
Nonvolatiles at 105° C, percent by weight, minimum	68
Viscosity, K.U. at 77° F	90-120
Set to touch at 77° F, minutes, maximum	45
Dry hard at 77° F, hours, maximum	5
Storage life, months, minimum	12

The mixed paint shall have a zinc content of not less than 80 percent by weight of the total nonvolatile content. Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating. The necessary additives to prevent gas formation in the containers during storage shall be incorporated into the formulated paint.

## Performance Requirements

Test panels of steel meeting the requirements of ASTM D 609-61 having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces to meet Steel Structures Painting Council Specification, SSPC-SP 10-63. The blast cleaned surfaces shall have a nominal height of profile of 1 to 2.5 mils. A three mil coating (dry thickness) shall be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

(a) Fresh Water Resistance

Panels shall be scribed down to base metal with an x of least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening when examined after 30 days.

(b) Salt Water Resistance

Panels shall be scribed down to base metal with an x of at least 2 inch legs and immersed in a 5 percent sodium chloride solution at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening upon examination after 7, 14 and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

(c) Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours of continuous exposure, the coating shall show no rusting or loss of adhesion to the steel test panel or blistering.

(d) Salt Fog Resistance

Panels shall be scribed with an x of at least 2 inch legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

Color

The Organic Zinc-Rich Primer shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish paint.

Application

The manufacturer's current printed instructions for application of Organic Zinc-Rich Primer shall be submitted to the Trials and Tests Unit for review.



## VINYL FINISH PAINT

### Description

This special provision covers a ready-mixed vinyl finish paint of the air-drying type.

Paint shall be homogeneous, free of contaminants and of a consistency suitable for use in the capacity for which it is specified. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not thicken in the container, and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning or other requisite qualities of a satisfactory working material. The paint shall possess satisfactory properties, in all respects which affect its application and curing.

### Composition

#### (a) Pigments

The pigment shall consist essentially of Titanium Dioxide, Phthalocyanine Green, and Chrome Oxide Green. All pigment components, including any tinting or extender pigments, shall be chemically pure, non-reactive and color permanent. Pigments shall be blended so as to obtain a proper color match. The pigments shall be lead free.

#### (b) Vehicle

The vehicle shall consist essentially of vinyl resins dissolved in appropriate solvents. A primary ingredient shall be vinyl chloride-vinyl acetate maleic acid tripolymer resin. The remainder of the resin shall be vinyl chloride-vinyl acetate copolymer or partially hydrolyzed copolymer.

(c) Properties of Mixed Paint

Weight per gallon, pounds, minimum	8.0
Viscosity, K.U. at 77° F	60-100
Nonvolatile, percent by weight, minimum	35.0
Pigment content, percent by weight, minimum	12.0
Water, percent by weight, maximum	1.0
Coarse particles and skins as residue retained on Standard 325 mesh screen, percent by weight, maximum	1.0
Fineness of grind, Hegman Units, minimum	6.0
Set to touch at 77° F, minutes, maximum	30
Dry for recoating at 77°F, hours, maximum	3

Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength. Other ingredients, such as antigelling agents, which may be necessary to meet all of the requirements of these special provisions, may be included. The preparation of this paint in steel ball mills is not acceptable.

Performance Requirements

Test panels shall be prepared from new cold-rolled steel, rust free No. 20 gage (0.0375 inches) meeting the requirements of Federal Specification QQ-S-698 for cold-rolled carbon steel strip. The test panels having dimensions of 2 inches by 5 inches, shall be used in the chemical resistance, flexibility and salt spray resistance tests. The test panels shall be blast cleaned to meet Steel Structures Painting Council Specification, SSPC-SP 10-63 with a nominal height of profile of 1 to 2.5 mils. A three mil coating (dry thickness) shall be applied to the test panels in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer.

The following tests shall be performed. Failure of the paint to conform to any of the requirements of the following tests, shall be cause for rejection of the paint.

(a) Chemical Resistance

The vinyl finish paint shall show no visual deterioration, other than minor discolorations, after seven days exposure to:

- (1) 10 percent sulfuric acid solution
- (2) 10 percent sodium hydroxide solution
- (3) 10 percent sodium chloride solution
- (4) Distilled water

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ARTECH CORP FALLS CHURCH VA  
REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS, (U)  
SEP 79 F ORDWAY, M J HAMMELL  
ARTECH-J7600.159-FR

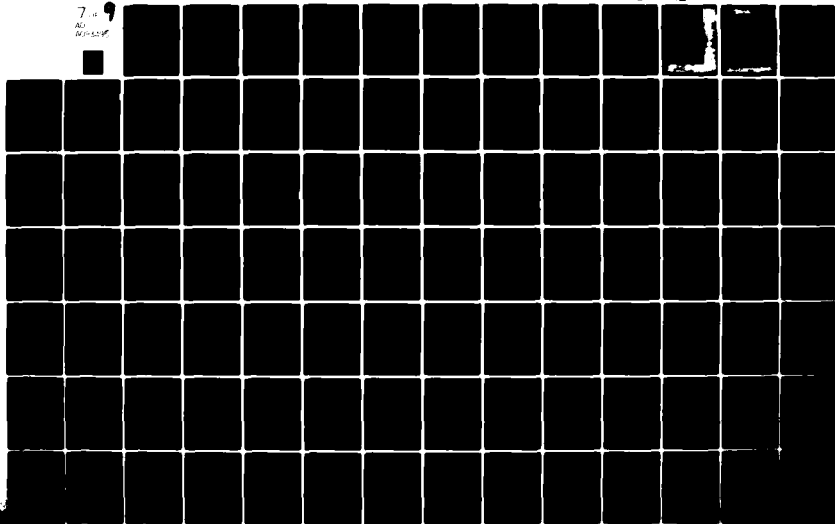
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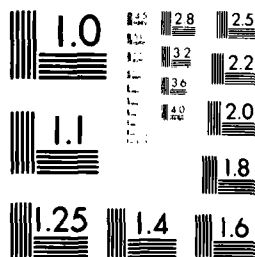
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MICROCOPY RESOLUTION TEST CHART  
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(b) Flexibility

The vinyl finish paint shall show no cracking or loss of adhesion or cohesion when the coated panel is bent 180° around a 1-inch mandrel with the coating on the tension side. The bending test shall be made at 73° ± 2° F.

(c) Salt Spray Resistance

The vinyl finish paint shall show no softening, blistering, embrittlement or loss of adhesion after removal from 275 hours of exposure to salt spray. The salt spray test shall be conducted in accordance with the requirements of Federal Test Method Standard No. 141a, Method 6061.

(d) Compatibility

50 cc of paint shall be able to be mixed with 50 cc of the manufacturer's recommended thinner without curdling, livering, separating or otherwise affecting the paint except to thin it.

Application Properties

The paint shall be a freely working product with good leveling properties. Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating. The paint, when applied as recommended by the manufacturer, shall lay up in a uniform wet film, free from seeds, striations, craters, pinholes, runs or sags. The sprayed paint film shall exhibit uniform color and appearance.

The manufacturer's current printed instructions for application of Vinyl Finish Paint shall be submitted to the Materials and Tests Unit for review.

Color

The vinyl finish paint shall be green, matching color No. 24272 of Federal Standard No. 595. Specific dry-film color match will be required.



ARTECH CORP. 2901 Telestar Court Falls Church, Virginia 22042 (703) 560-3292

September 19, 1979

Mr. David K. O. Leer, P.E.  
Materials and Research Engineer  
State Highway Department  
State Highway Bldg., Capitol Grounds  
Bismarck, North Dakota 58505

Dear Sir:

We are compiling for the Navy a comparison of all the specifications now in use or proposed for zinc-rich paints or primers (both the inorganic and organic types). If you have such a specification, we should very much like to obtain a copy. If you employ a specification issued by a national organization, such as the Steel Structures Painting Council, a reference to their designation would also be appreciated. The information should be addressed for my attention - a return envelope is enclosed.

We are grateful for your cooperation. The results will benefit our Navy and ultimately will help to improve the quality and economy of the nation's rust-protection technology.

Sincerely yours,

ARTECH CORP.

*Fred Ordway*

Fred Ordway  
Executive Vice President

FO/jb

*ASTA. D-79*

*David K.O. Leer*

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Consumer Protection • Power Sources • Materials • Instrumentation • Testing • Analysis

STATE OF OHIO  
DEPARTMENT OF TRANSPORTATION

84 OCT 1977

SUPPLEMENTAL SPECIFICATION 846

PAINTING FOR NEW STRUCTURAL STEEL

April 25, 1977

846.01 Description. This item consists of preparing surfaces of new structural steel for painting, furnishing all paint and incidental materials, and applying one prime and one finish coat of paint as specified.

846.02 Materials. Materials shall conform to the following specifications.

Prime Paint . . . . . Supplemental Specification 950

Finish Paint . . . . . Supplemental Specification 951

846.03 General. The surfaces to be painted shall be free of moisture or frost and the ambient temperature during application shall be not less than that specified.

Before the paint is applied, it shall be mixed to a uniform consistency which shall be maintained during its application.

Each coat of paint shall be applied as a continuous film of uniform thickness which is free of holidays, pores, runs or sags. The minimum dry film thickness for each coat shall be 3.0 mils when measured with a calibrated film thickness gauge.

The paint shall be applied by either airless or conventional spray methods except that small touch-up areas may be brushed. Spray application shall produce a wet coat at all times, the deposition of semi-dry particles on the surface shall be avoided.

Concrete shall be adequately shielded to protect it from overspray and to enable obtaining complete coverage of the steel surfaces near the concrete-steel junctures.

The paint may be thinned for spraying to suit the prevailing wind, temperature and humidity conditions; the type of thinner and the amount used shall be recommended by the printed instructions of the manufacturer.

846.04 Surface Preparation for Prime Coat. All surfaces to be primed shall be blast cleaned to conform to Grade Sa 2-1/2 of ASTM D 2200 (SSPC-SP-10 meets this requirement). Cleaning shall be done with suitable abrasives to produce a surface with a nominal height of profile of 2.5 mils.

Blast products shall be removed from the surfaces, and all surfaces shall be approved by the Engineer prior to painting.

Where touch-up of primer coat is required, cleaning of small areas, less than 1/2 square foot, by wire brushing is permitted.

Welds not blast cleaned shall be neutralized.

846.05 Mixing Two-Component Prime Coat Paints. When a two-component prime coat paint is to be used, it shall be mixed thoroughly to assure complete suspension of the pigment. After the initial mixing of the components, the paint shall be strained through a metal screen not coarser than 30 mesh nor finer than 60 mesh.

846.06 Application of Prime Coat. The minimum ambient temperature shall be 25F.

Painting shall be completed before the cleaned surfaces have degraded from the prescribed standards, but in every case within 24 hours.

All exposed steel surfaces shall be given a prime coat in the shop except surfaces which are to be embedded in concrete and surfaces within 2 inches of field welds other than those attaching intermediate or end crossframes to beams or girders. Contact surfaces of connection or splice material which are to be fastened with high strength bolts need not be primed except where these surfaces are cleaned incidental to cleaning other areas. Exposed areas not primed in the shop, field welds, field installed fasteners and areas where the prime paint has been damaged by handling, shipping or erection processes shall be primed in the field.

If the proper dry-film thickness is not obtained with the initial application, an additional application of primer thinned with up to 2 quarts of recommended thinner per gallon of paint shall be applied to obtain the required thickness for the prime coat; however, the dry film thickness shall not exceed 6.0 mils.

If "mud-cracking" occurs, the affected area shall be scraped to soundly bonded paint and the area recoated.

Wet paint damaged by rain, snow or condensation shall be permitted to dry; the damaged paint shall then be removed and the surface repainted.

846.07 Drying of Prime Coat. The prime coat shall be thoroughly cured before the steel is handled or the finish coat is applied. This curing time shall be not less than that recommended by the paint manufacturer's printed instructions.

846.08 Surface Preparation for Finish Coat. The prime coat shall be free of foreign materials, or if necessary it shall be cleaned by the use of bristle brushes, high pressure water spray or washing with solvents.



STATE OF OHIO  
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 950

INORGANIC ZINC SILICATE PAINT

April 25, 1977

950.01 Description. This specification covers inorganic zinc silicate paints that are either two-component or acid catalyzed single-component paints which will cure without the use of a separate curing solution when mixed and applied according to the manufacturer's instructions.

950.02 General Requirements. The inorganic zinc silicate paint shall meet or exceed the tentative requirements of Steel Structures Painting Council Specification PS 12.00.

950.03 Pigment. The pigment shall meet the composition requirements of ASTM D 520, Type II.

950.04 Vehicle. The vehicle of the two-component paint shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate alcohol solvent, and shall have the following composition and properties.

	<u>Minimum</u>	<u>Maximum</u>
SiO <sub>2</sub>	9.0%	12.0%
Nonvolatiles at 221F for 3 hours	39.0%	43.0%
Weight per gallon, pounds at 77F	9.2	9.6
Storage life, months at not above 77F	12	-

950.05 Mixed Paint. Single-component paint and two-component paint mixed according to the manufacturer's instructions shall have the following composition and properties:

	<u>Minimum</u>	<u>Maximum</u>
Weight per gallon, pounds at 77F	17.0	19.0
Total solids percent by weight when heated at 221F for 3 hours		
single component	67.0	-
two component	72.0	-
Metallic zinc in total solids percent by weight		
single component	81.0	-
two component	75.0	-

The two-component paint shall have a usable pot life of not less than 8 hours at 77F. The single-component paint shall have a storage life of not less than 6 months. There shall be no hard settling during either the pot life or storage life that cannot be easily dispersed.


When applied by spray to panels prepared as described in 950.07, a dry film thickness of  $6.0 \pm 0.5$  mils shall be obtainable with good adhesion and freedom from cracks observable by the unaided eye.

950.06 Color. The inorganic zinc coating shall be formulated to produce a distinct color contrast with the blast cleaned metal surface.

950.07 Performance Requirements. One panel for each of the specified tests shall be prepared to the requirements of ASTM D 609 except that the thickness shall be 1/8 inch minimum, the surface shall be blast cleaned to equal as nearly as is practical the standard Sa 2 1/2 of ASTM D 2200 (Steel Structure Painting Council SSPC-SP10 meets this requirement), and the surface shall have a nominal height of profile of 2.5 mils.

The panels shall be both coated and permitted to cure in accordance with the manufacturer's printed instructions. The coating shall have a dry film thickness of  $3.0 \pm 0.5$  mils.

The paint shall pass each of the following tests.

- 
- a. Fresh Water Resistance. The panel shall be scribed to the depth of the base metal in the form of an "X" having at least 2-inch legs and then immersed in fresh tap water at  $75 \pm 5$ F. After 30 days of immersion, the panel shall show no rusting nor shall the coating show any blistering or softening.
  - b. Salt Water Resistance. The panel shall be scribed as specified in "a" above and then immersed in a water solution of 5 percent sodium chloride at  $75 \pm 5$ F. The panels shall show no rusting nor shall the coating exhibit any blistering or softening after 7, 14, and 30 days. The sodium chloride solution shall be replaced with a fresh solution after the examination at 7 and 14 days.
  - c. Weathering Resistance. The panel shall be tested in accordance with ASTM G 23 Type D. The panel shall be placed on test at the beginning of a wet cycle; after 1000 hours continuous exposure, the coating shall show no blistering or loss of adhesion, nor shall the panel show any rusting.
  - d. Salt Fog Resistance. The panel shall be scribed as specified in "a" above, and then tested in accordance with ASTM B 117. After 1000 hours of continuous exposure the coating shall show no loss of bond nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.
  - e. Resistance to Elevated Temperatures and Thermal Shock. The panel shall be exposed to a temperature of 500F for 1 hour and then immediately quenched in  $65 \pm 5$ F tap water. After quenching, the panel shall show no blistering or flaking of the coating.

950.08 Packaging and Labeling. Containers shall be new metal cans or pails that will not be corroded by the paint or paint components. Two-component paint shall be packaged in portions that enable the combination of an entire single container of pigment and vehicle to produce a convenient-to-utilize quantity having the properties specified herein. Each container shall bear a label displaying the name of the manufacturer, brand name, lot number, date of manufacture, net weight of contents and complete instructions and precautions for their use. For the two-component paint, the instructions and precautions need only be placed on the vehicle component container.

950.09 Testing and Certification. Prior to use, the Contractor shall submit to the Director copies of the manufacturer's certified test data showing that the material complies with the qualitative, quantitative and performance requirements of this specification. The test data shall be developed by an approved independent testing laboratory, and shall include the brand name of the paint, name of the manufacturer, number lot tested, date of manufacture and for two-component paint the ratio by weight of the pigment component to the vehicle component of the paint used for the tests. When the paint has been approved for use by the Director, further performance testing by the manufacturer will not be required unless the formulation or manufacturing process has been changed; new certified test results will be required when either has been changed.

Each lot of paint shipped for project use shall be certified to be in compliance with this specification and to be the same as the paint subjected to the certification tests.

STATE OF OHIO  
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 951

BLUE-GREEN VINYL PAINT

April 25, 1977

951.01 Description. This specification covers a vinyl paint suitable for a finish coat applied directly to inorganic zinc prime coats.

951.02 General. The paint shall be compatible with and provide adequate adhesion to cured inorganic zinc paint when applied in accordance with the manufacturer's printed instructions.

951.03 Vehicle. The vehicle shall consist essentially of vinyl chloride-vinyl acetate copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure an adequate tensile strength for the paint film.

951.04 Mixed Paint. The mixed paint shall have the following composition and properties.

	<u>Minimum</u>	<u>Maximum</u>
Pigment	27.0%	-
Vehicle Solids	21.0%	-
Total Solids	48.0%	-
Weight per gallon, pounds at 77F	9.0	11.0

The solids shall be finely ground and shall not be livered, skinned or settled to the degree that they cannot easily be redispersed.

951.05 Color. The vinyl paint shall be a blue-green shade, Color No. 14241, Federal Standard No. 595.

951.06 Packaging and Labeling. Containers shall be new metal cans or pails that will not be corroded by the paint. Each container shall bear a label displaying the name of the manufacturer, kind of paint, brand name, lot number, date of manufacture, net weight of contents and complete instructions and precautions for its use.

951.07 Testing and Certification. Prior to use, the Contractor shall submit to the Director copies of the manufacturer's certified test data showing that the material complies with the requirements of this specification. The test data shall be developed by an approved independent testing laboratory, and it shall include the brand name of the paint, name of the manufacturer, number of lot tested and date of manufacture. When the paint has been approved by the Director for use, further performance testing by the manufacturer will not be required unless the paint formulation or manufacturing process has been changed, in which case new certified test results will be required.

Each lot of paint shipped for project use shall be certified to be in compliance with this specification and to be the same as the paint subjected to the certification tests.

846.09 Application of Finish Coat. The minimum ambient temperature shall be 35F.

After the structural steel is erected and primed, and all superstructure concrete has been placed, all exposed surfaces specified to be primed shall be given one finish coat.

846.10 Dating and Identifying. The completion date, month and year, of the finish coat and the letters "ZV" shall be stenciled in a contrasting color at a location directed by the Engineer. Payment for this work is included in the price bid for Item 846.

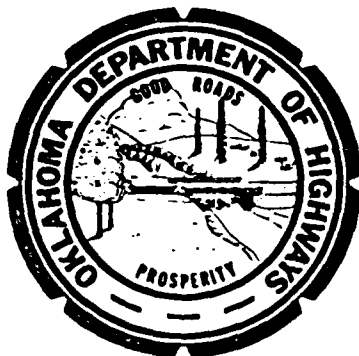
846.11 Method of Measurement. Field-applied painting and associated cleaning are measured by the plan weight of steel or by a lump sum. Separate measurement for the shop applied painting and associated cleaning is not made.

846.12 Basis of Payment. Payment for cleaning and painting specified to be done in the shop is considered as included in the price bid for Item 513, Structural Steel (primer per 846).

Payment for field painting will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
846	Pounds, lump sum	Field painting of structural steel

*Kente Townsend*  
*April 9, 1976*



# Standard Specifications

FOR

*4 OCT 1976 P.M.*

## HIGHWAY CONSTRUCTION

OKLAHOMA  
STATE HIGHWAY COMMISSION

Edition of 1976

No. **00013**

with the addition of 0.25 to 0.50 percent of lamp  
black (based on the insoluble pigment),

730.04

following characteristics  
essentially free of blue PVA

30 maximum

210 to 235 cp  
1.18

9.8 (1.18 kg/l)

Solution  
Appearance  
Clear  
Clear  
Clear  
Clear  
Clear

Slightly soluble  
Slightly soluble

moderately hard film, rapid  
cured.

will comply with above

ASTM D 962, Type II.

ASTM TT-X-916, Grade B.  
Use a product having a  
Stormer viscometer.  
of the theoretical gallon

It shall be taken to prevent  
no longer than necessary  
entrapped air.  
each container.

Specification as to pigment,  
weights and weight per gallon.

Manufacturing tolerance as to composition shall be  $\pm 5$  percent. The  
manufacturer may be required to furnish documentary evidence as to the  
materials used.

(d) Shop Paint-Basic Lead Silico Chromate, Ready-Mixed Primer Type V  
(AASHTO M-229). The color is specified as follows:

ECC-NBS Color-Name Chart NBS Circular 553	Minimum	Maximum
	No. 37 m.r. 0 Munsell Renotation 9.3R 5.5/9.2	No. 38 d.r. 0 9.3R 4.0/9.1

(e) First Field Paint - Basic Lead Silico Chromate Ready-Mixed Primer  
Type II AASHTO M-229. The color is specified as follows:

ECC-NBS Color-Name Chart	Minimum	Maximum
	Munsell Renotation 0.3YR 3.1/9.9	No. 43 m.r. Br 9.0R3.4/5.2

(f) Green Finish Coat - (FHWA BPR Spec. FP69, 708.03 (3) Page 413)

1. The green finish coat shall conform to color No. 125 m 01G of the  
ECC-NBS Color-Name Chart (NBS Circular 553) Munsell Renotation 5.7  
GY 3.6/4.8 and shall be basic lead silico chromate green paint meeting the  
following requirements.

2.	Min. Percent Max. Percent	
	Min. Percent	Max. Percent
Pigment Composition		
Basic Lead silico chromate	62.0	—
Titanium dioxide (rutile, non-chalking)	—	28.0
Phthalocyanine green, phthalocyanine blue, lampblack (tint to desired shade)	—	1.5
Chromium oxide	9.0	—
Organo-montmorillonite gelling agent (pre-wet with 20 to 30 percent methyl alcohol)	0.3	0.7
3.	Min. Percent Max. Percent	
	Min. Percent	Max. Percent
Vehicle Composition		
Non-Volatile vehicle	66.0	—
Raw linseed oil	28.0	—
Alkyd resin solids	38.0	—
Mineral spirits, driers and anti-skinning agent	—	36.0
Phthalic anhydride, percent of non-volatile vehicle	11.0	—
4.	Minimum	Maximum
Paint Characteristics		
Pigment %	55	58
Vehicle %	42	45
Pounds per gallon	13.5	—
Water %	—	1.0
Course particles and skins%	—	1.0
Fineness of grind (Hegman)	4	—
Consistency (Krebs-Stormer), Krebs Units	75	85
Drying time: set to touch	—	6 hours
dry through	—	24 hours

(g) Inorganic Zinc Two Coat Paint System.

1. General: This Specification covers a two-coat paint system consisting of an inorganic zinc ethyl silicate base primer and a hi-build vinyl topcoat for painting structural steel.

## 2. Materials. Inorganic Zinc Silicate Paint.

2.1.0 Description. Inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed, and applied in accordance with the Specification shall cure without the use of a separate curing solution and shall have the properties described herein.

### 2.2.0 Composition.

2.2.1. Pigment. The pigment shall be of a finely divided zinc powder containing, by weight, a minimum of 94 percent metallic zinc and 98 percent total zinc. All other fillers shall be inert substances.

2.2.2 Vehicle. The vehicle component shall consist primarily of an ethyl silicate in an appropriate alcohol solvent. Total solids, by weight, in the vehicle component shall not be less than 21 nor more than 45 percent. The solids content shall be determined by drying the sample to a constant weight at 100° C (212° F).

2.2.3 Mixed Paint. Mixed paint shall meet the following requirements.

a. The zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.

b. The total solids, when heated at 100° C for 3 hours, shall not be less than 80 percent by weight.

c. The paint shall tolerate up to one percent water contamination without gellation.

d. The usable pot life of the mixed paint shall be not less than 12 hours at 25° C. There shall be no hard settling which cannot be easily redispersed during this period.

e. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surface and with the vinyl finish coat.

2.3.0 Resistance. One coat 2 1/2 to 3 mils (dry thickness) shall be applied in accordance with the manufacturer's current instructions on all surfaces of 2x4x1/8 inch (5.1x12.7x0.032 cm) steel panels. The panels shall be of cold rolled steel, dust free, degreased properly with an aromatic solvent like xylol. No blasting or etching of the steel panels is allowed.

2.3.1 Fresh Water Resistance. Panels shall be scribed down to base metal with an x of at least 2 inch (5.1 cm) legs and shall be immersed in fresh water at 24° ± 3° C (75° ± 5° F). The panels shall show no rusting, blistering or softening upon after 30 days.

2.3.2 Salt Water Resistance. Panels shall be scribed down to base metal with an x of at least 2 inch (5.1 cm) legs and immersed in 5 percent sodium

chloride at 24° ± 3° C (75° ± 5° F). The panels shall show no rusting, blistering, or softening upon examination after 7, 14 and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.

2.3.3 Weathering Resistance. Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel, or blistering.

2.3.4 Weathering and Salt Fog Resistance. Panels shall be tested in the weatherometer as specified in 3.3 for 300 hours. After this period the panels shall be removed and scribed with an x of at least 2 inch (5.1 cm) legs down to base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure the coating shall show no loss of bond nor shall it show rusting or blistering beyond 1/16 inch (1.6 mm) from the center of the scribe mark.

2.3.5 Resistance to Elevated Temperatures and Thermal Shock. Panels shall be exposed to a temperature of 260° C (500° F) for one hour, then quenched immediately in 18° ± 3° C (65° ± 5° F) water. Panels subjected to this test shall show no blistering or flaking of the coating.

2.4.0 Application. 3 mil (dry thickness). The coating shall be capable of being applied in accordance with Specification requirements. All application shall be done in accordance with the manufacturer's printed instructions. Procedures shall conform to the following requirements:

2.4.1 After initial mixing, the paint shall be strained through a metal 30-60 mesh screen.

2.4.2 Stirring paddles on mechanical mixers shall reach to within one inch (2.54 cm) of the bottom of the stirring container during mechanical mixing.

2.4.3 Airless spray equipment for application of inorganic zinc silicate paint shall provide pressure of about 2200 psi (1517 kPa) at the nozzle. Fluid hose between pot and nozzle shall not be less than 3/8 inch (9.5 mm) inside diameter. Pressure may vary depending on tip size and pump.

2.4.4 Conventional spray equipment for application of inorganic zinc silicate paint shall provide pressure of not less than 10 psi (69 kPa) at the pot and 30 psi (207 kPa) at the nozzle. Fluid hose between pot and nozzle shall not be less than 1/2 inch (12.7 mm) inside diameter.

2.4.5 The inorganic zinc primer coat shall not be applied when the surrounding air temperature is below 4° C (40° F).

2.5.0 Packaging and Labeling. The paint shall be packaged so that one unit of the pigment can be mixed with the vehicle in its container. The containers must be coated or otherwise protected if necessary to prevent attack by the paint.



### 3. Materials. Vinyl Finish Coat.

3.1.0 Description. The vinyl finish coat shall be manufactured by the supplier of the inorganic zinc primer. The vehicle shall consist essentially of vinyl chloride vinyl acetate copolymer resin dissolved in aromatic or ketone-aromatic solvents. The vinyl coat shall display compatibility with, and adhesion to, the cured inorganic zinc primer film when applied over the inorganic zinc primer surface in accordance with the manufacturer's printed application instructions of latest date.

#### 3.2.0 Composition.

3.2.1 The vinyl finish coat shall be aluminum in color unless otherwise specified and supplied in a single package at a consistency ready for use. It shall be well ground and not caked, livered, skinned or badly settled in the container. When a color other than aluminum is specified, color chips shall be submitted to the Materials Laboratory for approval.

3.2.2 The vinyl finish coat shall contain not less than 29 percent pigment (by weight) and 19 percent vehicle (by weight) for a total of no less than 48 percent solids by weight. The weight per gallon shall be  $9.6 \pm 0.5$  pounds ( $1.15 \pm 0.06$  kg/l) at  $25^\circ\text{C}$  ( $77^\circ\text{F}$ ).

3.2.3 The vinyl finish coat shall air dry at temperatures of  $21^\circ\text{C}$  or above to a hard tough film within 4 hours, entirely by evaporation of solvents. It shall be dry to touch in about 20 minutes at  $21^\circ\text{C}$  ( $70^\circ\text{F}$ ).

#### 3.3.0 Application.

3.3.1 All application of the vinyl finish coat shall be done in accordance with the manufacturer's printed instructions.

3.3.2 The inorganic zinc primer shall have dried a minimum of one week under normal conditions and all surfaces shall be free of any soluble residue or excessive amounts of loose zinc before the vinyl finish coat is applied.

Dust and dirt, which may be accumulated on the surface, shall be removed from the dried film with a soft brush or rag before application of the subsequent coat.

3.3.3 When applied by brushing or spraying, the coating shall deposit a uniform dry film thickness of 3 mils without running or sagging.

3.3.4 The vinyl finish coat shall not be applied when the surrounding temperature is below  $4^\circ\text{C}$  ( $40^\circ\text{F}$ ) and shall not be applied when the temperature is expected to drop to  $0^\circ\text{C}$  ( $32^\circ\text{F}$ ) before the paint has dried.

#### 4. Testing and Certification.

4.1.0 Manufacturer and Brand Name Approval for Paint Systems. Prior to approval and use of inorganic zinc, the Contractor shall submit in triplicate to the Materials Engineer a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative and resistance test requirements of these Specifications. The certified test

report shall also contain the exact ratio, by weight, of the pigmented component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the Engineer of this certified test report, further resistance tests will not be required except as hereinafter noted of that manufacturer for that brand name of paint for a period of 2 years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed, and may be required by the Engineer when random sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

4.1.1 Samples. In addition to the above, at the time of original request for approval of the paint, the manufacturer shall submit a one-gallon sample of the material to the Materials Division of the Oklahoma Department of Highways. The Department reserves the right to perform any or all of the tests required by this Specification as a check on the tests reported by the manufacturer. In case of any variance, the Departmental tests will govern.

4.2.2 Approved Products. A list of approved products is kept by the Materials Division. Products may be qualified by the submission of samples to the Materials Division for evaluation of durability and appearance. The Department reserves the right to discontinue such approval of products that prove unsatisfactory when used in accordance with the manufacturer's instructions.

4.2.3 A Type C certification shall be furnished for each shipment of the previously approved product.

5.6 Inspection. The average total dry thickness of the 2-coat system shall be no less than  $5\frac{1}{2}$  mils ( $0.15$  mm). The dry mil film thickness of the paint will be measured in place with a calibrated magnetic film thickness gage and repainting will be required for any areas found deficient in thickness.

730.05. PAINT FOR WOOD SURFACES. (a) General. These formulae are intended for new wood structures, or handrails. When white paint is specified it shall be ready-mixed paint conforming to Federal Specification TTP 103 B. When a colored finish is specified the prime coat shall be as specified above. The finish coat shall conform to Federal Specification TTP 105 A with the necessary tint added.

730.06. ZINC-DUST ZINC-OXIDE PRIMER FOR GALVANIZED SURFACES. The material shall be a ready mixed paint conforming to Federal Specifications TT-P-641, Class B, Type I.



9/22/79

ARTECH CORP. 2901 Telestar Court Falls Church, Virginia 22042 (703) 560-3292

September 19, 1979

Mr. Robert L. Fruggiero  
Supervising Civil Eng. Materials  
Dept. of Transportation  
310 State Office Bldg.  
Providence, Rhode Island 02903

4 02:45 P.M.

Dear Sir:

We are compiling for the Navy a comparison of all the specifications now in use or proposed for zinc-rich paints or primers (both the inorganic and organic types). If you have such a specification, we should very much like to obtain a copy. If you employ a specification issued by a national organization, such as the Steel Structures Painting Council, a reference to their designation would also be appreciated. The information should be addressed for my attention - a return envelope is enclosed.

We are grateful for your cooperation. The results will benefit our Navy and ultimately will help to improve the quality and economy of the nation's rust-protection technology.

Sincerely yours,

ARTECH CORP.

Fred Ordway  
Executive Vice President

FO/jb

RECEIVED

R. I. DEPT. OF TRANSPORTATION  
DIV. OF PUBLIC WORKS  
MATERIALS SECTION

H - 258

Consumer Protection • Power Sources • Materials • Instrumentation • Testing • Analysis

809.9999

PAINTING STRUCTURAL STEEL

DESCRIPTION:

The work included under this code shall consist of all labor, materials, and equipment necessary to blast clean and paint the structural steel. The entire girder composed of flanges, webs, deck plate, floor beams, ribs, stiffeners, cross bracings, and fascia plates shall be painted except for the upper surface of the deck plate. Two coats of paint shall be applied to the prepared surfaces at the steel fabrication plant before shipment. The initial coat shall be inorganic zinc silicate paint and the finish coat shall be vinyl paint. Unpainted, damaged and/or defective areas shall be cleaned and repainted at the bridge site after erection. All work shall be performed in accordance with these Specific Special Provisions, as shown on the Plans, and applicable portions of the Rhode Island Standard Specifications (revision of 1971) with corrections and addenda.

MATERIALS:

A. INORGANIC ZINC SILICATE PAINT

DESCRIPTION:

1. The inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed and applied in accordance with the manufacturer's instructions, cures without the use of a separate curing solution, and shall have the properties described herein.
  - (a) The inorganic zinc silicate paint shall meet or exceed the requirements of Steel Structures Painting Council Specification PS 12.00. It shall also meet or exceed the requirements for use on contact surfaces of structural joints using ASTM A-325 or A-490 bolts.
2. Composition
  - (a) Pigment

The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a

minimum of 94 percent metallic zinc and a minimum of 96 percent total zinc. The zinc powder shall have a specific gravity of 7.00 to 7.15 as determined using the procedure set forth in ASTM Designation D520. All other fillers contained in the pigment shall be inert substances.

(b) Vehicle

The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in appropriate alcohol solvent.

Vehicle Composition and Properties

Nonvolatile at 105°C for 3 hours, percent by weight	39 - 43
SiO <sub>2</sub> percent by weight of vehicle (without pigments)	9.0 - 12.0
Weight per gallon, pounds at 77°F	9.2 - 9.6
Storage life of vehicle at 77°F months minimum	12

(c) Properties of Mixed Paint

The total zinc portion shall be at least 75 percent by weight of the total solids of the dried coating.

The total solids, when heated at 105°C for 3 hours shall be not less than 72 percent by weight.

The paint shall tolerate up to one percent water contamination by weight without gellation.

The usable pot life of the mixed paint shall be not less than 8 hours at 77°F. There shall be no hard settling which cannot be easily re-dispersed during the period.

When applied by spray to panels prepared as shown in Section 3.0 (a) at a dry film thickness of 6.0 ± 0.5 mils, the film shall exhibit good adhesion and when observed with the unaided eye shall be free from cracks.

Weight per gallon, pounds at 77°F 17.0 - 19.0

(d) Color

The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the vinyl finish coat.

B. VINYL FINISH COATING

1. Description

The vinyl paint for the finish coat shall be manufactured by the supplier of the inorganic zinc primer. It shall display compatibility with and adhesion to the cured inorganic zinc paint when applied directly over the inorganic zinc paint in accordance with the manufacturer's current printed instructions.

2. Composition

(a) Vehicle

The vehicle shall consist essentially of vinyl chloride-copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

(b) Mixed Paint

Vinyl paint shall contain not less than 29 percent pigment by weight and 19 percent vehicle solids by weight, for a total solids content of not less than 48 percent by weight. Total weight per gallon at 77°F shall be 10.0 ± 1.0 lbs.

Vinyl paint shall be supplied in a single package. It shall be well ground and shall not be caked, livered, skinned, or badly settled in the container. All containers shall be cleaned of any paint spilled during filling operations. Containers shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture, and complete instructions for their use.

(c) Color

The color for the vinyl finish coat shall match the Department of Transportation standard gray-green color and be approved in advance by the Engineer.

#### CLEANING OF SURFACES:

- (a) Surfaces to be painted with inorganic zinc paint shall be blast cleaned with abrasives producing a nominal height of Profile of 1.5 mils. The blast cleaned surfaces shall meet the following requirements:
- (1) All oil, grease, dirt, rust scale and other foreign matter shall be completely removed except as hereinafter modified.
  - (2) All rust, mill scale and old paint shall be removed.
  - (3) At least 95 percent of each square inch shall be free of all visible residues and the remainder shall be limited to light discoloration.
  - (4) Surfaces shall be cleaned to a condition at least equal to the appearance of the pictorial surface preparation standard, labeled Sa 2-1/2 in ASTM D2200-67, that applies to the starting rust grade of the steel.

Surfaces cleaned to meet Steel Structures Painting Council Specification SSPC-SP 10-63 will meet these requirements.

#### RESISTANCE TESTING:

Test panels of steel meeting the requirements of ASTM D 609-61 (1968) having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning as previously specified. A three mil coating (dry thickness) shall be applied to the test plates in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed. If any individual test panel fails any of the following tests, the material will not be accepted.

##### (1) Fresh Water Resistance

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at 75°F+5°F. The panels shall show no rusting, blistering or softening when examined after 30 days.

##### (2) Salt Water Resistance

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at 75°F+5°F. The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

(3) Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel or blistering.

(4) Salt Fog Resistance

Panels shall be scribed with an X of at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

(5) Resistance to Elevated Temperatures and Thermal Shock

Panels shall be exposed to a temperature of 500°F for one hour, then quenched immediately in 65°F - 5°F water. Panels subjected to this test shall show no blistering or flaking of the coating.

PACKAGING AND LABELING:

Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle, will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint, the lot number, and date of manufacture. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

APPLICATION

The manufacturer's current printed instructions for application of inorganic zinc coating shall be submitted to the Highway Department for review and approval.

Minimum dry film thickness in mils:

Inorganic zinc paint	_____	3
Vinyl finish coating	_____	4

MANUFACTURER AND BRAND NAME APPROVAL FOR INORGANIC ZINC PAINT AND VINYL PAINT:

Prior to approval and use of any inorganic zinc, the manufacturer shall submit to the State Highway Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ratio by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's

name, brand name of paint, and date of manufacture. Upon approval by the State Highway Department of this certified test report, further resistance tests will not be required, except as herein-after noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the State Highway Department when random sampling and testing of material offered for use indicated nonconformance to any of the requirements herein specified.

To obtain final acceptance of the inorganic zinc, the manufacturer shall furnish a certification stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The State Highway Department reserves the right to sample and test any or all materials supplied.

#### MEASUREMENT AND PAYMENT:

The cost of all labor, materials, and equipment necessary to blast clean and paint the structural steel in accordance with these special provisions, will be included in the contract lump sum price bid in the proposal for: Code 800.0714 Superstructure - Structural Steel.





SOUTH CAROLINA

DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PO BOX 191  
COLUMBIA, SC 29202

October 1, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

Attached is our specification for Inorganic Zinc Paint. We do not have a specification for Organic Zinc Paint. If we can be of further help to you please advise.

Yours very truly,

Richard L. Stewart, P.E.  
Research and Materials Engineer

Attachment

10/1/79

## SPECIAL PROVISIONS FOR PAINTING OF STRUCTURAL STEEL

### 1. DESCRIPTION OF PAINT SYSTEM:

All structural steel shall be painted with one shop coat of Inorganic Zinc silicate paint and one finish (field) coat of Vinyl paint as specified and outlined in these Special Provisions and the project plans.

### 2. SHOP PAINTING:

#### A. Surface Preparation:

All structural steel shall be cleaned to the requirements of Near-white Blast Cleaning in accordance with the Steel Structures Painting Council-Surface Preparation SP10-63T, "No. 10 Near White Blast Cleaning" method. The quality of the blast cleaning shall be such that the prime coat of inorganic zinc specified will adhere tightly to the steel in all cases.

All surfaces to be in contact with concrete, areas adjacent to bolted connections and splices, including bolt holes, shall be cleaned as stated above.

#### B. Inorganic Zinc Primer:

All structural steel which has been cleaned as described under 2A Surface Preparation shall receive one (1) full coat of an approved inorganic zinc primer in accordance with the requirements of the attached ADDENDUM dated June 19, 1978, entitled, "Inorganic Zinc Silicate Primer".

#### C. Application of Paint:

All Inorganic Zinc shall be applied within 12 hours after cleaning and before any rusting occurs. All paint shall be applied in accordance with the Manufacturer's written recommendations by people skilled in this type of work.

D. Paint Thickness Requirements:

When mixed and applied according to the manufacturer's application instructions, a minimum film of four mils dry thickness without film cracking, sagging, or loss of adhesion shall be obtained.

E. Additional Coatings and Touch-Up:

If the required four mils dry film thickness is not obtained on the first application, then an additional coat shall be applied according to the manufacturer's instruction.

3. FIELD PAINTING:

A. Surface Preparation:

All surface areas that have been damaged during shipment, erection, or construction shall be cleaned using wire brushes or other suitable tools of all rust or objectionable material to the satisfaction of the Engineer before applying field touch-up coat.

B. Field Touch-Up Coat:

Immediately after field cleaning and before any rusting occurs (within 12 hours), apply one coat of primer that is recommended by the Manufacturer and approved by the Engineer.

C. Field Coat:

All structural steel shall receive one (1) full coat of Vinyl finish paint in accordance with the requirements of the attached ADDENDUM dated June 19, 1978, entitled "Vinyl Finish Coating Over Inorganic Zinc Primer".

D. Application of Paint:

There is no limit to the allowable time between the application of the Inorganic Zinc Primer and the Vinyl Finish coat, provided the inorganic zinc cured film is free of dirt, oil, grease and other contaminants before application of the single full coat of Vinyl paint.

The inorganic zinc primer shall have cured a minimum of 16 hours before the vinyl finish coat is applied.

E. Paint Thickness Requirement:

When applied by spraying, the coating shall deposit a uniform dry film thickness of five (5) mils without running or sagging.

4. CONDITION FOR PAINTING:

Paint shall be applied only when the surrounding air temperature is above 40° F. Paint shall not be applied upon damp surfaces nor shall paint be applied when the air is misty, or otherwise unsatisfactory for the work, in the opinion of the Engineer.

All containers of paint shall remain unopened until required for use. Containers which have been opened shall be used first. Paint which has livered, gelled, or otherwise deteriorated during storage shall not be used. Wet paint shall be protected against damage from dust, sand or other detrimental foreign matter to the extent practicable. During painting operation, precautionary measures shall be taken to protect any surfaces not to be painted or which have already been painted. The Contractor will also be responsible for repairing and spot-painting any areas of paint film damaged by his own operations. The Contractor will be responsible for the satisfactory removal of all spillages, dripping, spattering, or inadvertent applications caused by his operations.

5. BASIS OF PAYMENT:

All cost of equipment, materials and labor necessary to paint the structural steel in accordance with these Special Provisions and ADDENDUMS thereto shall be included in the unit price bid for Structural Steel.

6-19-78

SOUTH CAROLINA DEPARTMENT OF  
HIGHWAYS & PUBLIC TRANSPORTATION

INORGANIC ZINC SILICATE PAINT

- 1.0 Description:  
The inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed and applied in accordance with the manufacturer's instructions, cures without the use of a separate curing solution, and shall have the properties described herein.
- 1.1 The inorganic zinc silicate paint shall meet or exceed the requirements of Steel Structures Painting Council Specification PS 12.00. It shall also meet or exceed the requirements for use on contact surfaces of structural joints using ASTM A-325 or A-490 bolts.
- 2.0 Composition:
- 2.1 Pigment  
The zinc portion of the pigment shall be finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc and a minimum of 98 percent total zinc. The zinc powder shall have a specific gravity of 7.00 to 7.15 as determined using the procedure set forth in ASTM Designation D135. All other fillers contained in the pigment shall be inert substances.
- 2.2 Vehicle  
The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate alcohol solvent.

VEHICLE COMPOSITION AND PROPERTIES

Nonvolatile at 105° C for 3 hours, percent by weight	39-43
SiO <sub>2</sub> percent by weight of vehicle (without pigments)	9.0-12.0
Weight per gallon, pounds at 77° F.	9.2-9.6
Storage Life of vehicle at 77 °F, months minimum	12

### 2.3 Mixed Paint

#### Properties of Mixed Paint

- (a) The total zinc portion shall be at least 75 percent by weight of the total solids of the dried coating.
- (b) The total solids, when heated at 105° C for 3 hours shall be not less than 72 percent by weight.
- (c) The paint shall tolerate up to one percent water contamination by weight without gellation.
- (d) The usable pot life of the mixed paint shall be not less than 8 hours at 77° F. There shall be no hard settling which cannot be easily redispersed during the period.
- (e) When applied by spray to panels prepared as shown in Section 3.0 (a) at a dry film thickness of 6.0  $\pm$  0.5 mils, the film shall exhibit good adhesion and when observed with the unaided eye shall be free from cracks.
- (f) Weight per gallon, pounds at 77° F                      17.0 - 19.0

### 2.4 Color

The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish coat if a finish coat is specified.

### 3.0 Resistance

Test panels of steel meeting the requirements of ASTM D 609-61 (1968) having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces as designated in paragraph (a) below. A three mil coating (dry thickness) shall be applied to the test plates in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed. If any individual test panel fails any of the following tests, the material will not be accepted.

- (a) Surfaces to be painted with inorganic zinc paint shall be blast cleaned with abrasives producing a nominal height of Profile of 1.5 mils. The blast cleaned surfaces shall meet the following requirements:
  - (1) All oil, grease, dirt, rust scale and other foreign matter shall be completely removed except as hereinafter modified.
  - (2) All rust, mill scale and old paint shall be removed.
  - (3) At least 95 percent of each square inch shall be free of all visible residues and the remainder shall be limited to the light discoloration.

### 3.0 Resistance (Cont'd.)

- (4) Surfaces shall be cleaned to a condition at least equal to the appearance of the pictorial surface preparation standard, labeled Sa 2- 1/2 in ASTM D2200-67, that applied to the starting rust grade of the steel.

Surfaces cleaned to meet Steel Structures Painting Council Specification SSPC-SP 10-63 will meet these requirements.

#### 3.1 Fresh Water Resistance

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening when examined after 30 days.

#### 3.2 Salt Water Resistance

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

#### 3.3 Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel or blistering.

#### 3.4 Salt Fog Resistance

Panels shall be scribed with an X of at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

#### 3.5 Resistance to Elevated Temperatures and Thermal Shock

Panels shall be exposed to a temperature of  $500^{\circ}\text{F}$  for one hour, then quenched immediately in  $65^{\circ}\text{F} \pm 5^{\circ}\text{F}$  water. Panels subjected to this test shall show no blistering or flaking of the coating.

4.0

Packaging and Labeling

Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle, will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint, the lot number, and date of manufacture. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

5.0

Application

The manufacturer's current printed instructions for application of inorganic zinc coating shall be submitted to the Department for review and approval.

6.0

Manufacturer and Brand Name Approval for Inorganic Zinc Paint

Prior to approval and use of any inorganic zinc, the manufacturer shall submit to the Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ratio by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, The manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the Department of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the Department when random sampling and testing of material offered for use indicated non-conformance to any of the requirements herein specified.

To obtain final acceptance of the inorganic zinc, the manufacturer shall furnish a certification stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The Department reserves the right to sample and test any or all materials supplied.



6-19-78

SOUTH CAROLINA DEPARTMENT OF  
HIGHWAYS and PUBLIC TRANSPORTATION

VINYL FINISH COATING OVER INORGANIC ZINC PRIMER

- 1.0 Description  
The vinyl paint for the finish coat shall be manufactured by the supplier of the inorganic zinc primer. The manufacturer shall furnish reference and certify that the vinyl finish coat has been used successfully over the inorganic zinc for at least two (2) years in similar service and environment. Successful performance must include sustained adhesion and compatability of the vinyl finish coat to the inorganic zinc primer without a tie-coat.
- 2.0 Composition
  - 2.1 Vehicle  
The vehicle shall consist essentially of vinyl chloride-copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.
  - 2.2 Mixed Paint
    - 2.2.1 Vinyl paint shall contain not less than 29 percent pigment by weight and 19 percent vehicle solids by weight, for a total solids content of not less than 48 percent by weight. Total weight per gallon at 77° F shall be 10.0 ± 1.0 pounds.
    - 2.2.2 Vinyl paint shall be supplied in a single package. It shall be well ground and shall not be caked, livered, skinned, or badly settled in the container. All containers shall be cleaned of any paint spilled during filling operations. Containers shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture, and complete instructions for their use.
- 2.3 Color  
The color for the vinyl finish coat shall be light blue, subject to the approval of the Engineer.

3.0

Manufacturer and Brand Name Approval for Vinyl Paint

Prior to approval and use of any vinyl paint, the manufacturer shall submit to the Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ratio by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the Department of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the Department when random sampling and testing of material offered for use indicated nonconformance to any of the requirements herein specified.

To obtain final acceptance of the vinyl paint the manufacturer shall furnish a certification stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The Department reserves the right to sample and test any or all materials supplied.

## SPECIAL PROVISION

## REGARDING

PAINTING STEEL STRUCTURES  
(Inorganic Zinc - Vinyl System)1978  
4 OCT 1 P.M.

Painting shall be in accordance with the provisions of Section 603 of the Standard Specifications except as modified in this Special Provision.

Subsection 603.02 - Materials

Delete this subsection and add the following:

Materials shall conform to the requirements of this Special Provision. All paint or paints, unless otherwise stipulated, shall be manufactured and prepared to comply with the following specifications and other specifications included herein by reference.

## 1.0 INORGANIC ZINC SILICATE PAINT

1.1 Description

This paint shall be either a two-component or acid catalyzed single component, self-cure ethyl silicate zinc rich paint which, when mixed and applied in accordance with these specifications, cures without the use of a separate curing solution, and shall have the properties described herein.

1.2 Composition1.2.1 Pigment

The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc. All other materials contained in the pigment or pigment component shall be inert.

1.2.2 Vehicle

The vehicle component of the two-component type shall have a store-life at 77 degrees F. of not less than 12 months.

### 1.3 Properties of Mixed Paint

#### 1.3.1 Properties

The single package paint or the two-component paint mixed in accordance with the manufacturer's instructions, shall meet the following requirements:

Weight per gallon at 77 degrees F., not less than 17.0 pounds;

Percent total solids, by weight:

Single component, not less than 67.0

Two-component, not less than 72.0;

Percent metallic zinc, by weight, of total solids:

Single component, not less than 81.0 %

Two-component, not less than 75.0;

The two-component type shall have a usable pot life of not less than 8 hours at 77 degrees F. The single component type shall have a storage life of not less than 6 months. There shall be no hard settling which cannot be easily dispersed during either the pot life or storage life periods.

#### 1.3.2 Color

The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast-cleaned metal surfaces and with the vinyl finish coat.

#### 1.3.3 Resistance

Test panels of steel meeting the requirements of ASTM D 609-61 (1968) having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces as designated in Section 603.05. A three mil coating (dry thickness) shall be applied to the test plates in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed. If any individual test panel fails any of the following tests, the material will not be accepted.

#### 1.3.4 Fresh Water Resistance

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at 75°F ± 5°F. The panels shall show no rusting, blistering or softening when examined after 30 days.

#### 1.3.5 Salt Fog Resistance

Panels shall be scribed with a X of at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

#### 1.3.6 Resistance to Elevated Temperatures and Thermal Shock

Panels shall be exposed to a temperature of 500°F for one hour, then quenched immediately in 65°F ± 5°F water. Panels subjected to this test shall show no blistering or flaking of the coating.

#### 1.4 Painting Conditions

No paint shall be applied to metal surfaces that are not entirely free from moisture or frost. Zinc silicate paint shall not be applied when the atmosphere surrounding the metal is at a temperature below 35 degrees F. When painting in a protected area to eliminate the above conditions, the steel shall remain under cover until the paint is dry. Any wet paint exposed to excessive humidity, rain, snow or condensation shall be permitted to dry, and damaged paint shall then be removed and the surface recleaned and repainted. Paint shall not be applied under any conditions of weather that in the opinion of the engineer are unsatisfactory for painting.

#### 1.5 Packaging and Labeling

Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle, will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer of brand name of paint, the lot number, and date of manufacture. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

#### 1.6 Inspection and Testing

Prior to approval and use of any inorganic zinc, the manufacturer shall submit in triplicate to the State Department of Transportation a certified test report from an approved testing laboratory showing specific test results conforming to all requirements of these specifications. In addition, the certified test report shall contain the exact ration, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the State Department of Transportation of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the State Department of Transportation when random sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

To obtain final acceptance of inorganic zinc or vinyl paint, the manufacturer shall furnish a certification in triplicate certifying that the materials supplied conform to all the requirements specified, and for the inorganic zinc primer, stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The State Department of Transportation reserves the right to sample and test any or all materials supplied.

#### 1.7 Application

The manufacturer's current printed instruction for application of inorganic zinc coating shall be submitted to the materials and Tests Division, Tennessee Department of Transportation, for review and approval. The manufacturer of the inorganic zinc coating shall furnish a technical representative to assist and advise the applicator in the sandblasting and application of the zinc and vinyl finishes.



STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
NASHVILLE, TENNESSEE 37219

Bureau of Highways, Division of Materials and Tests  
2200 Charlotte Avenue, Nashville, Tennessee 37203

September 24, 1979

Dr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Dr. Ordway:

Enclosed is a copy of our specifications regarding zinc-rich paint. Tennessee only specifies inorganic types at present.

If we can be of further assistance please let us know.

Yours truly,

*Naaman R. Harper*  
Naaman R. Harper  
Assistant Chief of  
Laboratory Tests

NRH:ss

Enclosure



14 OCT 1979

COMMISSION

REAGAN HOUSTON CHAIRMAN  
DEWITT C GREER  
A SAM WALDROP

**STATE DEPARTMENT OF HIGHWAYS  
AND PUBLIC TRANSPORTATION**

Austin, Texas 78703  
September 26, 1979

ENGINEER-DIRECTOR  
B L DEBERRY

Subject: Zinc Rich Primers

IN REPLY REFER TO  
FILE NO D-9-B

Mr. Fred Ordway  
Executive Vice President  
ARTECH CORPORATION  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

In response to your request of September 19, 1979, on the above subject, we are attaching the following specifications.

1. Our standard specifications (D-9-1, 11-64). Current zinc primer specification may be found on page 3 of Special Provision No. 17.
2. Phenoxy-Zinc Primer Specification used for special projects.
3. Inorganic-zinc primer specifications used for special projects.

We trust that these specifications will serve your purpose.

Sincerely yours,

B. L. DeBerry  
Engineer-Director

By:

*Larry G. Walker*

Larry G. Walker  
Materials and Tests Engineer

JGR:cc

Attachments

TEXAS HIGHWAY DEPARTMENT  
SPECIAL PAINT SPECIFICATION  
ORGANIC ZINC-RICH PRIMER

- I. DESCRIPTION. This item shall govern the materials, composition, characteristics and testing of the coating specified herein.
- II. PAYMENT. Payment for all materials or coatings under this specification shall be in accordance with the conditions prescribed in the contract awarded by the Board of Control, or as listed in Item 446 of Texas Highway Department "Standard Specifications for Construction of Highways, Streets and Bridges".
- III. INTENT. The intent of the Texas Highway Department is to obtain a carefully formulated coating of the highest quality.
- IV. CONFORMANCE. Coatings covered by this Special Specification shall conform to all requirements set forth herein.
- V. SAMPLING AND TESTING.
- A. Materials to be Tested. All products required to meet this specification and bought either by the Texas Highway Department or by Contractors for use on projects under Texas Highway Department jurisdiction are required to be sampled and tested. One unopened container shall be sampled at random from each lot or batch of coatings upon arrival of the coating at the shipping destination.
- Federal Test Method Standard No. 141, latest revision, will be used unless otherwise noted in the Texas Highway Department's Manual of Testing Procedures. Any questions regarding sampling or testing should



be addressed to the Materials and Tests Engineer, Texas Highway Department, Austin, Texas 78703.

B. Agency. All sampling and testing will be made by the Texas Highway Department or by a commercial laboratory designated by the Materials and Tests Engineer, Texas Highway Department.

C. Cost. On material purchased directly by the Texas Highway Department, the cost of sampling and testing will be borne by the Texas Highway Department.

On material purchased on the open market by Contractors, all costs of sampling and testing, whether performed by the Texas Highway Department or by a commercial laboratory designated by the Texas Highway Department, will be charged against the Contractor and deducted from the amounts due him on Monthly and Final Estimates.

D. Basis for Rejection. Materials which fail to meet any requirements of this specification shall be subject to rejection. Final acceptance or rejection shall be based on results of tests on the finished products after their arrival at shipping destination. The judgment of the Texas Highway Department's Materials and Tests Engineer shall be final in all questions relative to conformance with the provisions of this specification.

VI. FINISHED PRODUCTS. The finished product, when canned, shall be free of skins and foreign materials. Consistency and gallon weight determinations on coatings are made at 77°F. Consistency is measured with Krebs modified Stormer. Containers shall be filled by weight based on the actual gallon weight of the paint at 77°F.

VII. CONTAINERS AND MARKINGS. Coatings will be packaged in accordance with requirements listed in the bid request or purchase order. Containers shall be suitable, strong and well sealed, meeting specification and DOT requirements as well as being sufficiently sturdy to withstand the normal rough handling to which shipments are subjected in transit. Finished coating containers and cases shall be plainly and securely labeled with the name and designation of the coating, order number, requisition number, batch number, date of manufacture, gross weight and manufacturer's name.

VIII. COATING REQUIREMENTS. The coating specified herein is a one package, thermoplastic organic zinc primer whose mechanism of dry is that of solvent release.

The coating is intended for application by brushing or spraying (either conventional or airless spray).

A. Vehicle. The clear vehicle obtained by centrifuging the coating shall be a solution of a polyhydroxy polyalkaryl polyether in suitable solvents. When four parts by volume of clear vehicle are diluted with two parts by volume of a mixture of 82 percent by volume of ethylene glycol monoethyl ether acetate and 18 percent by volume of toluene, the resulting solution shall show no cloud, haze or indication of incompatibility. The polyhydroxy polyalkaryl polyether shall be identifiable by infrared analysis as one having the following typical characteristics:

Specific Gravity	1.18
Viscosity at 40% solids in methyl ethyl ketone, Brookfield RVF, 20 rpm, No. 5 spindle	5,500 to 7,700 cps

Ultimate tensile strength	9,000 to 9,500 psi
Ultimate tensile elongation	50 to 100%
Softening temperature	212°F
Bulking Value	9.83 lb. per gal.

B. Pigment. The extracted pigment from the whole paint shall be a minimum of 90.2 percent metallic zinc. The remainder of the pigment shall be zinc oxide, thixotropes and additives.

C. Whole Paint. The whole paint shall conform to the following characteristics:

Volatiles at 105°C, percent by wt.	32.0 max.
Metallic zinc based on total solids, percent by wt.	83.0 min.
Viscosity, KU at 77°F	100-120
Dry time at 77°F, 50% relative humidity, 6 mil wet thickness:	
Set to touch, hours	3/4 max.
Dry hard, hours	5 max.
Storage life, years	1 min.

When the whole paint is thinned with not more than one volume of a mixture of 82 percent by volume of ethylene glycol monoethyl ether acetate and 18 percent by volume toluene to four volumes of paint, it shall produce a coating suitable for spraying to produce a smooth uniform coating. When undisturbed for one hour, a 2/3 full pint can of the thinned coating shall not exhibit any hard settling of pigment. After redispersion of any soft settled pigment, moderate agitation shall keep the pigment properly dispersed throughout the coating.

The dry film produced by a ten mil wet film of thinned coating applied to a white metal blasted steel panel, anchor pattern one to two mils, allowed to air dry five hours at 77°F and then exposed to 140°F for 20 hours, shall not show any indication of adhesion loss, film cracking or other film defect.

TEXAS HIGHWAY DEPARTMENT  
SPECIAL SPECIFICATION  
FOR  
INORGANIC ZINC RICH COATING

- I. SCOPE: This specification covers the type, quality, methods of testing, and method of packaging of an inorganic zinc rich coating to be used to prevent corrosion of steel.
- II. GENERAL: The coating shall be a self-cured ethyl-silicate type inorganic zinc coating meeting the requirements of either Coating A or Coating B as set forth below. Requirements as set forth below for either coating do not relieve the manufacturer of any obligations relating to patents, nor does it give the manufacturer the right to patent infringement.

In addition to meeting the requirements as set forth in this specification, prospective coating suppliers must submit with their bid a list of jobs or structures within the Houston or Beaumont, Texas areas on which his coating has been used, documenting satisfactory performance for a minimum of ten years. The Materials & Tests Engineer reserves the right to inspect any or all of the sites listed by the supplier. In the event the Engineer deems inspection is necessary, the supplier shall secure permission from the owner for such inspection to be made by Texas Highway Department personnel.

In the event a proposed inorganic zinc coating has not been on the market for ten years, the supplier may, in lieu of documenting ten years of satisfactory performance, document satisfactory performance by submitting a list of projects showing satisfactory performance dating back to the time the material was placed on the market. A minimum of seven years may be acceptable provided performance is satisfactory in the opinion of the Engineer.

### III. COATING REQUIREMENT:

- A. Coating A. Coating A shall be a solvent based inorganic zinc coating of the self-curing ethyl-silicate type.

The coating shall be supplied as a two-component system, one component being the liquid or vehicle portion, and the other component being the filler or powder portion, with both components to be mixed prior to use to form the complete coating. The coating shall be packaged such that when one can of vehicle and one can of powder are mixed, the two components will be mixed in correct ratios. The mixing ratio of the two components shall be  $6.5 \pm 0.1$  pounds of vehicle to  $15.0 \pm 0.2$  pounds of powder. Each container shall be labeled vehicle or powder, depending on its contents.

- A.1 Vehicle of Liquid Component: The vehicle shall be a solution of ethyl-silicate containing suspending agents and inert filler material.

An infrared spectra of the clear vehicle, obtained by centrifuging, shall match the infrared spectra on file at the Materials & Tests Division of the Texas Highway Department.

X-Ray diffraction patterns of the clear and whole vehicle shall match the x-ray diffraction patterns on file at the Materials & Tests Division of the Texas Highway Department.

A gas chromatographic analysis of the clear vehicle shall show that the volatile portion of the vehicle is a mixture of xylene and ethanol. A gas chromatographic analysis of the hydrolyzed clear vehicle shall show that the volatile hydrolyzation product is ethanol only. Percent solids by weight of the clear vehicle shall be between 14.2 and 15.6. Percent solids on the whole vehicle shall be between 30.0 and 33.0.

The pH of the vehicle shall show the vehicle to be basic.

A.2 Powder: The powder component of Coating A shall be essentially zinc dust with a minimum of 93.5 percent zinc metal.

X-Ray diffraction shall indicate the presence of iron oxide in the powder component.

The powder shall be free of hard lumps or agglomerates of zinc dust.

A.3 Mixed Coating A: When mixed in the correct proportions of vehicle to powder, the resulting material shall be of sprayable viscosity and slight agitation shall keep the zinc dust properly suspended. When the mixed primer is applied to blasted steel to achieve a 3 mil dry film, the coating shall be water insoluble within 15 minutes above 32°F and within 30 minutes at 32°F.

Moisture shall aid in achieving maximum film hardness with the cured film being reddish-gray to gray in color with a matte finish. No alkali metal salts shall be formed during curing. A 3 to 4 mils dry film applied to white metal blasted steel and cured for a minimum of 24 hours at 70 to 80°F and 50 to 100% relative humidity shall withstand temperatures up to 600°F with no film deterioration.

The mixed coating shall have a theoretical coverage of approximately 1000 mil square feet per gallon as determined by the void Content Measurement Method. The applied coating shall completely cure for topcoating in 24 hours at 70°F and 50% relative humidity. Pot life of the mixed coating in a sealed container protected from moisture shall be a minimum of 24 hours at 70 to 120°F.

B. Coating B. Coating B shall be a self-cured solvent based inorganic zinc coating of the ethyl-silicate type.



The coating shall be supplied as a two-component system, one component being the liquid or vehicle and the other component being the filler or powder portion, with both components to be mixed prior to use. The coating shall be packaged such that one container of liquid mixed with one container of filler will result in a coating containing the correct ratio of liquid to filler. The mixing ratio of the two components shall be  $6.6 \pm 0.1$  pounds of liquid to  $14.6 \pm 0.2$  pounds of filler. Each container shall be labeled liquid or filler, depending on its contents.

B.1 Liquid or Vehicle Component: The liquid component shall be a solution of ethyl silicate containing suspending agents and inert filler material.

An infrared spectra of the clear liquid, obtained by centrifuging, shall match the infrared spectra on file at the Materials and Tests Division of the Texas Highway Department.

X-Ray diffraction patterns of the clear and whole vehicle shall match the x-ray diffraction patterns on file at the Materials and Tests Division of the Texas Highway Department.

A gas chromatographic analysis of the clear vehicle shall show that the volatile portion is a mixture of ethanol, butyl cello-solve and xylene. A gas chromatographic analysis of the hydrolyzed clear vehicle shall show that the volatile hydrolyzation product is ethanol only.

Percent solids of the clear vehicle shall be between 11.0 and 12.1. Percent solids of the whole vehicle shall be between 37.0 and 40.0. The pH of the vehicle shall show the vehicle to be acid.

B.2 Filler: The filler component of Coating B shall be essentially zinc dust with a minimum of 95.0 percent zinc metal. X-ray diffraction shall indicate that the filler is essentially zinc metal and zinc oxide, and any impurities are in trace quantities. The filler shall be free of hard lumps or agglomerates of zinc dust.

B.3 Mixed Coating B: When mixed in the correct proportions of vehicle to filler, the resulting mixed material shall be of sprayable viscosity and slight agitation shall keep the zinc dust uniformly suspended throughout the entire mass of material.

When the mixed coating is applied to blasted steel to achieve a 3 mil dry film, the coating shall be water insoluble within 15 minutes above 32 F.

Moisture in the form of atmospheric moisture or spray mist shall aid in achieving maximum film hardness with the cured film being gray in color. There shall be no alkali metal salts formed in the curing process.

A 3 to 4 mil dry film applied to white metal blasted steel and cured for a minimum of 24 hours at 70 to 80 F and 50 to 100% relative humidity shall withstand temperatures up to 600 F without film deterioration.

The mixed coating shall have a theoretical coverage of approximately 1000 mil square feet per gallon.

A properly applied 3.0 mils dry film shall be completely cured at temperatures from 70 to 80 F and relative humidities above 50% within 24 hours.

The potlife of the mixed coating when placed in a sealed container to protect against moisture contamination shall not be less than 12 hours at 45 F, 8 hours at 75 F, and 4 hours at 95 F.

#### IV. TEST METHODS:

- A. Percent solids on vehicle of Coatings A and B shall be determined as per Test Method Tex-808-B.
- B. Chemical analysis by x-ray, infrared, or other electronic analysis methods as well as by standard wet analysis methods.
- C. Any test listed in Federal Test Method Standard No. 141a.

TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PAINT SPECIFICATIONS

- I. DESCRIPTION. This item shall govern the materials, composition, manufacture, and testing of paints, varnishes, chemicals, and other protective and/or decorative coatings used for maintenance, construction, and safety.
- II. BIDDER'S REQUIREMENTS
  - A. Procurement by the State. All prospective bidders are hereby notified that, before any bid is considered, the State Board of Control may require the bidder to submit a statement in detail of facts as to the previous experience of the bidder in performing similar or comparable work, as to the business and technical organization, financial resources, and the manufacturing facilities of the bidder which are to be used in performing the contemplated work. Any bid submitted by a firm with unsatisfactory facilities, resources, or experience will be rejected by the State Board of Control.
  - B. Open Market Purchases. When contractors are procuring materials on the open market, the Texas Highway Department reserves the same rights and authority delegated to the State Board of Control in paragraph IIA.
- III. PAYMENT. Payment for all materials or coatings under this item shall be in accordance with the conditions prescribed in the contract awarded by the Board of Control or as listed in Item 446 of Texas Highway Department "Standard Specification for Road and Bridge Construction".
- IV. INTENT. Only best quality materials and workmanship are intended. The coating design specified has been effected by means of carefully controlled formulations and durability testing methods. The intent of the Texas Highway Department is to procure coatings which are identical in all essential respects with the Standards.
- V. CONFORMANCE. Coatings shall conform, on a weight basis, to the composition requirements of the Standard Formulae as closely as accepted good paint practice will permit. No variation from the Standard Formulae will be permitted except for replacement of volatiles lost in processing, or those approved by the Engineer.

The finished coatings shall conform with the Constants requirements stipulated for each Standard Formulae and, in addition, shall equal a Wet Standard in all other characteristics such as for color, drying, flow, settling, brushability, can stability, hiding; for film characteristics of gloss, hardness, light permanency, adhesion; etc., when the coatings are applied and tested under parallel conditions with the Wet Standard.

VI. INSPECTION, SAMPLING, AND TESTING

- A. Materials to be tested. All products required to meet these specifications and bought either by the Highway Department or by contractors for use on projects under Highway Department jurisdiction are required to be inspected and tested.
- B. Agency. All tests on finished products and raw materials, as well as inspection during manufacture will be made by the Texas Highway Department or by a commercial laboratory designated by the Highway Department.
- C. Cost
  - 1. On material purchased directly by the Highway Department the cost of inspection and testing will be borne by the Highway Department.
  - 2. On material purchased on the open market by contractors, all cost of inspection and testing, whether performed directly by the Highway Department or by commercial laboratories designated by the Highway Department, will be charged against the contractor and deducted from the amounts due him on monthly and final estimates.
- D. Methods
  - 1. Sequence of Inspection
    - a. Immediately after the contract has been awarded, the supplier will contact the Materials and Tests Engineer, Texas Highway Department, Austin, Texas, regarding brand names and characteristics of all raw materials which the contractor proposes to use; and to make arrangements for inspection during production.
    - b. Manufacture shall be witnessed in whole or in part depending upon the discretion of the testing agency. Production will not begin prior to the arrival of the Highway Department inspector unless prior specific approval for such starting has been obtained. Samples of raw materials actually used in production and samples of paint will be taken during production. The manufacturer shall accord the inspector free access to those parts of the plant wherein the paints are being manufactured or raw materials are being stored, and in all other ways shall facilitate the inspector in performing his duties. FEDERAL TEST METHOD STANDARD NO. 141 will be used unless otherwise noted in the TEXAS HIGHWAY DEPARTMENT'S MANUAL OF TESTING PROCEDURES. Any questions regarding inspection or testing should be addressed to the Materials and Tests Engineer, Texas Highway Department, Austin, Texas.

2. **Basis for Rejection.** Materials and finished products which fail to meet any requirements of these specifications shall be subject to rejection. Final acceptance or rejection shall be based on results of tests on samples of raw material and paint taken during production and upon tests made on finished paints after their arrival at shipping destination. Approval of materials, as a result of preliminary testing prior to manufacture into finished coatings, shall not be binding upon final approval or rejection. Because of the possibility of contamination and volatile losses, it shall be agreed that only the Wet Standard, currently in the possession of the Highway Department or its authorized testing agencies, shall constitute Standards for final comparison involving acceptance or rejection. Samples of these standards are available to the manufacturer. The judgment of the Highway Department's Materials and Tests Engineer shall be final in all questions relative to conformance with the provisions of these specifications.

VII. **MANUFACTURING PROCEDURES.** Manufacturing procedures shall be left to the discretion of the contractor. The Highway Department may suggest certain procedures but so long as the raw materials and finished products meet the requirements of this specification, exact processing procedures are not specified.

VIII. **FINISHED PRODUCTS.** The finished product, when canned, shall be free from skins and foreign materials. Consistency and gallon weight determinations on coatings are made at 77°F. Consistency is measured with Krebs modified Stormer. Containers shall be filled by weight based upon the actual gallon weight of the paint at 77°F.

IX. **CONTAINERS AND MARKING.** Shipment shall be made in suitable, strong, well sealed containers which not only meet specification and ICC requirements but also are sufficiently sturdy to withstand the normal rough handling to which shipments are subjected in transit. Finished coating containers and cases shall be plainly and securely labeled with Texas Highway Department; the name and designation of the coating; order number; requisition number; batch number; date of manufacture; gross weight; and manufacturer's name.

X. **RAW MATERIALS**

A. **SUBSTITUTIONS.** The exact brands and types of raw materials used in the Wet Standard are listed for the purpose of facilitating the selection of parallel material equal not only in quality and composition, but also in physical and chemical behavior after aging in the finished product. Since evaluation of questionable materials may require sixty days after receipt of request from a paint manufacturer and since meeting delivery schedules is a responsibility of the paint manufacturer, he is reminded that he should schedule material procurement to permit him to meet delivery commitments. The final decision as to equality of materials shall be made by the Highway Department. After the Highway

Department has approved the brand names of raw materials proposed by the contractor, no substitution will be allowed during the manufacture without prior approval of the Highway Department.

- B. MATERIALS OF FOREIGN ORIGIN. Lack of information and absence of performance records for materials manufactured outside the Continental limits of the United States makes it difficult to evaluate these materials. To enable the Texas Highway Department to make all evaluations of materials necessary to assure our receipt of quality paints, the following procedure in addition to all other requirements of this specification will be followed for materials of foreign manufacture.

1. The paint manufacturer will be required to assemble and separate in his plant the total quantity of foreign manufactured materials proposed for use in paints to be purchased by the Texas Highway Department, and to keep these materials segregated during the entire time that these foreign manufactured materials are being sampled, tested, and used; Or
2. The paint manufacturer may use materials that have been evaluated and found acceptable to the Texas Highway Department. Such evaluations will be made after materials have been segregated in a way and stored in a location acceptable to the Texas Highway Department.

All foreign manufactured materials evaluated for use in paint destined for the Texas Highway Department that are found to be acceptable, are expected to be kept segregated and to be used in paint to be purchased by the Texas Highway Department.

C. PIGMENTS

1. White

- a. Pure Titanium Dioxide, Anatase; shall meet Federal Specification TT-P-442, Type I.  
In addition to materials meeting the above specification, materials such as the following will also be acceptable:

TiO<sub>2</sub>, Anatase, O-520, American Cyanamid  
TiO<sub>2</sub>, Anatase, PC, DuPont  
TiO<sub>2</sub>, Anatase, LDC, Glidden  
TiO<sub>2</sub>, Anatase, A-CG, Titanox  
TiO<sub>2</sub>, Anatase, A-440, New Jersey Zinc

- b. Pure Titanium Dioxide, Rutile; Non-Chalking, shall meet Federal Specification TT-P-442, Type III, Grade B.

- c. ~~Lead Free Zinc Oxide; American Process, Acidular,~~ *See Special Provision #15*  
shall meet Federal Specification TT-P-463a, *Provision #15*  
Type I.
- d. Lithopone; shall meet Federal Specification TT-P-400.
- e. Lead Carbonate; shall meet Federal Specification TT-W-251e, Type A.

2. Colored

- a. Pigments listed below must be similar and equal to the standard sample submitted to the Highway Department by the pigment manufacturer and approved by the Highway Department prior to the award of contract for coatings in which the pigment is proposed for use.

Chrome Yellow *See Special Provision #4*  
Yellow Iron Oxide  
Ultramarine Blue  
Phthalocyanine  
Quinacridone  
Molybdate Orange

- b. The following pigments shall meet the specifications as shown:

Black Iron Oxide; shall meet Federal Specification TT-P-390.

Carbon Black; shall meet Federal Specification TT-P-343.

Lamp Black; shall meet Federal Specification TT-P-350

Zinc Yellow; shall meet Federal Specification TT-P-465, Type I.

Red Lead; shall meet Federal Specification TT-R-191b, Type I, Grade 97.

Blue Lead; Dry Pigment; shall meet Federal Specification TT-B-486.



3. Metallic

- a. Aluminum Lining Paste, Leafing; shall conform to ASTM Specification D 962-49, Type II, Class B. Testing of aluminum paste shall conform to ASTM Method D-480-59T, except that the leafing test vehicle described in paragraph 8 shall be composed of 30 grams of Panarez 6-210 resin, 20 ml. of Xylol meeting ASTM D-364-61, and 80 ml. of Mineral Spirits meeting Federal Specification TT-T-291a, Grade I.

4. Inert

- a. Diatomaceous Silica, Calcined; shall meet Federal Specification 52 MC-522, Type II
- b. Talc, Paint Grade Magnesium Silicate; shall meet Federal Specification MIL-M-15173, Type B.
- c. Graphitic Mica, pigment Grade; shall meet Federal Specification MIL-M-15176A, Type II.
- d. Calcium Carbonate:

CaCO <sub>3</sub>	Min. 97%
H <sub>2</sub> O	Max. 0.4%
Specific Gravity	2.63 - 2.73
Weight retained on #325 screen	Max. 0.75%
Color:	Equal to material listed in Standard Formula. Substitution in a Standard Formula shall not result in a viscosity variation greater than 5 KU.

D. OILS, DRYING AND SEMI-DRYING

1. Raw Linseed Oil; shall meet ASTM D-234-55.
2. Dicyclopentadiene Modified Linseed Oil:

	<u>Min.</u>	<u>Max.</u>
Acid Number	-	4.0
Iodine Number, Wijs	150	180
Saponification Number	152	172
Refractive Index, 25°C	1.500	1.508
Viscosity, Gardner	Z-3	Z-4
Specific Gravity	0.975	0.985
Solids, %	99.5	-

3. Polymerised Linseed Oil:

	<u>Min.</u>	<u>Max.</u>
Acid Number	-	3.0
Iodine Number, Wijs	115	130
Saponification Number	190	199
Refractive Index, 25°C	1.483	1.491
Viscosity, Gardner	2-2	2-3
Specific Gravity	0.955	0.965
% Solids	99.5	-

4. Refined Linseed Oil:

*See Special Provision #10*

	<u>Min.</u>	<u>Max.</u>
Acid Number	-	6
Saponification Number	188	196
Iodine Number, Wijs	170	195
Viscosity, Gardner	A <sub>1</sub>	A
Refractive Index, 25°C	1.4770	1.4800
Specific Gravity	0.931	0.935
Color, Gardner 1953 Std.	-	2.0
% Solids	99.5	-

5. Dehydrated Castor Oil, G-H:

	<u>Min.</u>	<u>Max.</u>
Acid Number	-	6
Iodine Number, Wijs	125	140
Saponification Number	185	195
Refractive Index, 25°C	1.4805	1.4820
Viscosity, Gardner	F	H
Color, Gardner 1953 Std.	2	6
% Solids	99.	-

6. Natural Winter Sperm Oil:

	<u>Min.</u>	<u>Max.</u>
Acid Number	-	4
Iodine Number, Wijs	80	92
Saponification Number	130	140
Viscosity, SSU @100°F	95	110
Specific Gravity	.876	.884
Solids, %	100	-
Pour Point, ASTM °F	-	45°F
Cloud Point, ASTM °F	-	48°F
Surface Tension, Dynes/cm <sup>2</sup>	35	37

B. THINNERS

1. Mineral Spirits; shall meet Federal Specification TT-T-291a, Grade I
2. VM&P Naphtha; shall meet Federal Specification TT-N-95a, Type I
3. Toluol; shall meet Federal Specification JAN-T-171, Type B
4. Xylol; shall meet Federal Specification TT-X-916, Grade B
5. Methyl Isobutyl Ketone; shall meet Federal Specification TT-M-268b
6. Pine Oil; shall meet Federal Specification LLL-O-358, Class B
7. Butyl Cellosolve:  
Appearance: clear, free from sediment  
Color: Water white  
Boiling Range: 166° to 173°C  
Chemical Formula:  $C_4H_9OC_2H_4OH$
8. Kerosene:  
Appearance: clear, free from sediment  
Color: Water white  
Boiling Range: 350° to 520°F  
Kauri Butanol Value: 30 to 35
9. Dipentene; shall meet Federal Specification TT-D-376c
10. N-Butyl Alcohol; shall meet Federal Specification TT-B-846B
11. 2-Nitropropane:

	<u>Min.</u>	<u>Max.</u>
Specific Gravity	0.986	0.990
Distillation Range	246°F	252°F
Refractive Index	1.393	1.395
Surface tension, dynes/cm	29.5	30.5
Color	Water white	

F. RESINS

1. Long Oil Alkyd Resin Solution; shall meet Federal Specification TT-R-266a, Type I, Class A or B, or Type ~~II~~ <sup>III</sup>, Class A or B.

2. Medium Oil Alkyd Resin Solution, 50% Solids; shall meet Federal Specification TT-R-266a, Type III, with the following exceptions:

	<u>Min.</u>	<u>Max.</u>
Viscosity at 25°C, Gardner bubble viscometer tube	V	Y

3. Traffic Paint Alkyd Resin Solutions:

a. General:

Type: Pure drying alkyd  
Length: Medium  
Type Oil: Soya or linseed or mixture of the  
two  
Compatability: 500% in VM&P Naphtha  
Type Solvent: VM&P Naphtha

b. Solid Resin Basis:

Percent Phthalic Anhydrides	33 to 37
Percent Oil Acids	48 to 55
Acid Number, Max.	8
Ash Residue, Max.	0.05%
Unsaponifiable, Max.	1.0%
Iodine Number of fatty acids, Min.	115
Refractive Number of fatty acids, Min.	1.4660

c. 45% Solids Basis: \*

Color, Gardner 1953 Std. 9 Max.  
Viscosity, Gardner D to G  
Drying time; a film 3 mils thick shall set to  
touch in not more than 90 minutes.  
(Driers: Based on the resin solids present,  
add the equivalent of 0.06% Cobalt  
(metal) and 1.0% Lead (metal).)

\*VM&P Naphtha used to reduce the resin solution to 45%  
Solids must meet Federal Specification TT-N-95a.

4. Petroleum Resin:

Melting Point °F (Ring & Ball)	200 to 230
Acid Number	1 Max.
Saponification Number	2 Max.
Specific Gravity	1.0 Min.
Color - 50% solution by weight in Xylol shall be no darker than #15 Gardner Scale	
Compatability - A mixture, by weight, of 14% resin, 47% OKO S-70 oil, 32% mineral spirits, and 7% Xylol shall show no cloud or settling after 24 hours at 77°F	

5. Proprietary Resins: Resins listed below must be similar and equal to the standard sample submitted to the Texas Highway Department by the resin manufacturer and approved by the Texas Highway Department prior to the award of contracts for coatings in which the resin is proposed for use.

Polyurethane *See Special Provision # 10*  
Silicone  
Acrylic  
Chlorinated Rubber

G. ADDITIVES AND CHEMICALS

1. Driers; shall pass Federal Specification TT-D-643b, except that Tallates will be allowed.
2. Drier Catalyst; shall be an organic complex of zirconium in mineral spirits having a metal content of 6% zirconium.
3. Additives listed below must be similar and equal to the standard sample submitted to the Texas Highway Department by the manufacturer and approved by the Texas Highway Department prior to the award of contracts for coatings in which the additive is proposed for use.
  - Anti-Skinning Agent
  - Anti-Livering Agent
  - MPA
  - Bentone 38
  - Drier Preservative
  - Zinc Resinate Solution
  - Phenyl Mercuric Oleate
4. Caustic Soda; 76% Granular, Commercial Grade
5. Sodium Hexa Meta Phosphate; powdered,  $P_2O_5$  not less than 65%
6. Tetra Sodium Pyrophosphate;  $Na_4P_2O_7$ , dry, granular, anhydrous, commercial grade
7. Soya Lecithin:

Total Phosphatides (Acetone Insol.)	60% Min.
Moisture	1% Max.
Benzol Insoluble	0.3% Max.
Acid Number	10 Max.
Specific Gravity, 25°C	1.03 - 1.06
Color, Gardner 1953 Std.	17 Max.

# MAINTENANCE PAINTS

## WPF-1d White Paint, Exterior

	<u>Pounds</u>
<del>TiO<sub>2</sub>, Rutile, OR-580, American Cyanamid</del>	<del>150</del>
<del>TiO<sub>2</sub>, Anatase, FF, DuPont</del>	<del>100</del>
<del>Lead Carbonate, AAA, Eagle Picher</del>	<del>100</del>
<del>Talc, Fibrene, C-500, Sierra Talc</del>	<del>200</del>
<del>Diatomaceous Silica, Celite 281, Johns-Manville</del>	<del>100</del>
<del>Bentone 38, National Lead</del>	<del>2</del>
<del>Refined Linseed Oil</del>	<del>200</del>
<del>Polyurethane Resin, 50% Solids, F-77 MS, Spencer-Kellogg</del>	<del>200</del>
<del>Polymerized Linseed Oil, OKO S-70</del>	<del>100</del>
<del>24% Lead Drier</del>	<del>5</del>
<del>6% Cobalt Drier</del>	<del>2</del>
<del>6% Manganese Drier</del>	<del>2</del>
<del>6% Zirco Catalyst</del>	<del>2</del>
<del>Anti-Skinning Agent, Exkin</del>	<del>2</del>
<del>PMO, 10% Metal</del>	<del>5</del>
<del>Drier Preservative, Nuact Paste</del>	<del>8</del>
<del>Dipentene</del>	<del>15</del>
<del>VM&amp;P Naphtha</del>	<del>45</del>
<del>Butyl Alcohol</del>	<del>1</del>
	<u>1239</u>

~~Grind: 4 Min.~~

~~Consistency: 80 to 90 KU~~

~~Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight~~

~~SEE SPECIAL PROVISION #X 9~~

## OPE-1 Orange Paint, Exterior

	<u>Pounds</u>
Molybdate Orange, YE-673-D, DuPont	200
Talc, Visco XX, SCMC	250
Bentone 38, National Lead	2
Butyl Alcohol	2
Long Oil Alkyd Resin, 70% Solids	460
Anti-Skinning Agent, Exkin	4
24% Lead Drier	2
6% Cobalt Drier	2
6% Zirco Catalyst	2
Mineral Spirits	<u>165</u>
	1089

Grind: 4 Min.

Consistency: 85 to 95 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

YFE-1c Yellow Paint, Exterior

	<u>Pounds</u>
Medium Chrome Yellow, Y-469-D, DuPont	400
Diatomaceous Silica, White Filler, Dicalite	200
Zinc Yellow, Y-539-D, DuPont	100
Bentone 38, National Lead	4
Drier Preservative, Nuact Paste	8
Refined Linseed Oil	200
Polymerized Linseed Oil, OKO S-70	100
Polyurethane Resin, 50% Solids, 101 MS, Cargill	200
24% Lead Drier	4
6% Cobalt Drier	2
6% Manganese Drier	2
6% Zirco Catalyst	2
Anti-Skinning Agent, Exdin	2
VM&P Naphtha	75
Butyl Alcohol	1
	<u>1300</u>

Grind: 4 Min.

Consistency: 80 to 90 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

SEE SPECIAL PROVISION #X 10

BPE-1 Black Paint, Exterior

	<u>Pounds</u>
Carbon Black, Excelsior, Columbian Carbon	50
Black Iron Oxide, BK250, C.K. Williams	225
Raw Linseed Oil	200
Long Oil Alkyd Resin, 70% Solids	270
Bentone 38, National Lead	2
Drier Preservative, Nuact Paste	10
Soya Lecithin	4
24% Lead Drier	10
6% Cobalt Drier	4
Anti-Skinning Agent, Advance	4
Mineral Spirits	185
Butyl Alcohol	1
	<u>965</u>

Grind: 4 Min.

Consistency: 57 to 67 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

RFS-2 Red Enamel, Sign

	<u>Pounds</u>
Monastral Violet, RT-795-D, DuPont	10
Molybdate Orange, YE-698-D, DuPont	100
TiO <sub>2</sub> , Rutile, RA-45, Titanox	5
Long Oil Alkyd Resin, 70% Solids	534
Bentone 38, National Lead	2
24% Lead Drier	5
6% Cobalt Drier	3
6% Zirco Catalyst	3
Anti-Skinning Agent, Exdin	4
Mineral Spirits	175
Butyl Alcohol	<u>1</u>
	842

Grind: 7 Min.

Consistency: 63 to 73 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

Tint to Match Standard

GES-2b Green Enamel, Sign

	<u>Pounds</u>
Light Chrome Yellow, Y-433-D, DuPont	30
TiO <sub>2</sub> , Rutile, OR-580, American Cyanamid	25
Phthalo Green, GP-755-D, DuPont	60
Medium Oil Alkyd Resin, 50% Solids	610
Bentone 38, National Lead	2
24% Lead Drier	6
6% Cobalt Drier	3
Anti-Skinning Agent	4
Butyl Alcohol	1
Mineral Spirits	55
Xylol	<u>30</u>
	826

Grind: 7 Min.

Consistency: 70 to 80 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

Tint to Match Standard

*See*  
*S.P. #19*



WFS-2b White Enamel, Sign

	<u>Pounds</u>
TiO <sub>2</sub> , Rutile, RA-45, Titanox	250
Medium Oil Alkyd Resin, 50% Solids	620
Mineral Spirits	60
6% Cobalt Drier	3
24% Lead Drier	6
Anti-Skinning Agent, Milskin	4
Bentone 38, National Lead	4
Butyl Alcohol	1
	<u>948</u>

Grind: 7 Min.

Consistency: 71 to 81 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

YFS-2b Yellow Enamel, Sign

	<u>Pounds</u>
Medium Chrome Yellow, 40-4485, American Cyanamid	300
Medium Oil Alkyd Resin, 50% Solids	620
6% Cobalt Drier	3
24% Lead Drier	6
Anti-Skinning Agent, Raybo #17	4
Bentone 38, National Lead	4
Butyl Alcohol	1
Mineral Spirits	65
	<u>1003</u>

Grind: 7 Min.

Consistency: 71 to 81 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

BES-2 Blue Enamel, Sign

	<u>Pounds</u>
Phthalocyanine Blue, BP-366-D, DuPont	45
TiO <sub>2</sub> , Rutile, OR-580, American Cyanamid	75
Medium Oil Alkyd Resin, 50% Solids	600
Bentone 38, National Lead	4
Anti-Skinning Agent, Exkin	4
6% Cobalt Drier	3
24% Lead Drier	6
Butyl Alcohol	1
Mineral Spirits	95
Carbon Black	*
	<u>833</u>

Grind: 7 Min.

Consistency: 72 to 82 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

Tint to Match Standard

\*A small amount of Carbon Black must be used to achieve the standard color. If added in the form of a tinting paste no more than 10 pounds of paste per 100 gallons of paint may be used.

Paint Stripper, Caustic

	<u>Pounds</u>
76% Caustic Soda, Granular	100
Sodium Hexa Meta Phosphate, Calgonite	10
Tetra Sodium Pyrophosphate, Anhydrous	10
	<u>120</u>

Procedure: Dry mix. Shall not be mixed under moisture conditions which will cause lumping.

Package: Shall be packed in air-tight metal containers with friction closure lids, 4 or 6 to a case.

GPS-4b Green Paste, Stencil

	<u>Pounds</u>
TiO <sub>2</sub> , Rutile, RA-45, Titanox	60
Phthalo Green, GP-755-D, DuPont	35
Yellow Iron Oxide, YIO-1788, C. E. Williams	25
Calcium Carbonate, Atomite, Thompson-Wainman	450
Bentone 38, National Lead	15
Drier Preservative, Nuact Paste	6
Dehydrated Castor Oil, G-H	215
Long Oil Alkyd Resin, 70% Solids	215
Zinc Resinate, Zinol, Newport	10
6% Manganese Drier	1
24% Lead Drier	5
Anti-Skinning Agent, Rxxkin	4
Butyl Cellosolve	20
Kerosene	20
Mineral Spirits	70
	<u>1151</u>

Grind: 7 Min.

Consistency: Soft Short Paste (Match Standard)

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

WPF-5 White Paint, Fume Proof

	<u>Pounds</u>
TiO <sub>2</sub> , Rutile, R-900, DuPont	150
TiO <sub>2</sub> , Anatase, FF, DuPont	100
Lead Free Zinc Oxide, XI601, New Jersey Zinc	150
Talc, Asbestine #325, International Talc	200
Diatomaceous Silica, Celite 281, Johns-Manville	100
Bentone 38, National Lead	2
Refined Linseed Oil	250
Polyurethane Resin, 50% Solids, 101 MS, Cargill	100
Polymerized Linseed Oil, OKO S-70	100
24% Lead Drier	5
6% Cobalt Drier	2
6% Manganese Drier	2
6% Zirco Catalyst	2
Drier Preservative, Nuact Paste	8
Butyl Alcohol	1
Dipentene	15
VH&P Naphtha	85
	<u>1272</u>

Grind: 4 Min.

Consistency: 80 to 90 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

YFE-6 Yellow Enamel, Equipment

*See Special Provision # 11*

	<u>Pounds</u>
Medium Chrome Yellow, X-2541, Imperial	250
Molybdate Orange, #2504, Kentucky	10
Yellow Iron Oxide, X10-Mapico	10
Bentone 38, National Lead	2
Traffic Alkyd, 50% Solids	600
24% Lead Drier	2
6% Cobalt Drier	4
6% Zirco Catalyst	1
Anti-Skinning Agent, Exkin	4
VM&P Naphtha	85
Butyl Alcohol	1
	<u>972</u>

Grind: 7 Min.

Consistency: 62 to 72 KU

Gallon Weight:  $\pm .05$  lb. of theoretical gallon weight

Tint to Match Standard

BFE-6 Black Enamel, Equipment

	<u>Pounds</u>
Carbon Black, Excelsior, Columbian Carbon	25
Long Oil Alkyd Resin, 70% Solids	565
Drier Preservative, Nuact Paste	8
6% Cobalt Drier	4
24% Lead Drier	9
Anti-Skinning Agent, Exkin	2
Mineral Spirits	160
	<u>773</u>

Grind: 7 Min.

Consistency: 67 to 77 KU

Gallon Weight:  $\pm .05$  lb. of theoretical gallon weight

GEF-6 Gray Enamel, Equipment

	<u>Pounds</u>
TiO <sub>2</sub> , Rutile, R-900, DuPont	275
Lamp Black, Super Jet, C. K. Williams	10
Long Oil Alkyd Resin, 70% Solids	490
Bentone 38, National Lead	2
Butyl Alcohol	1
Drier Preservative, Nuact Paste	8
24% Lead Drier	6
6% Cobalt Drier	4
6% Zirco Catalyst	2
Anti-Skinning Agent, Eddin	4
Mineral Spirits	<u>170</u>
	972

Grind: 7 Min.

Consistency: 73 to 83 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

WRS-10 Water Repellent Solution

	<u>Pounds</u>
Silicone Resin, 33% Solids, R-27, Union Carbide	65
Mineral Spirits	<u>600</u>
	665

Color: Transparent, Water White

Silicone Resin Solids: 3% Minimum

IPT-7 Yellow Paint, Traffic

	<u>Pounds</u>
Medium Chrome Yellow, Y-469-D, DuPont	200
TiO <sub>2</sub> , Anatase, FF, DuPont	10
Lithopone, Permalith, Sherwin-Williams	150
Talc, Nyltal #300, Vanderbilt	300
Bentone 38, National Lead	2
Traffic Alkyd, 50% Solids	475
6% Cobalt Drier	3
24% Lead Drier	10
Anti-Skinning Agent, Exkin	2
Butyl Alcohol	2
VM&P Naphtha	85
	<u>1239</u>

Grind: 4 Min.

Consistency: 80 to 90 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

WPT-7b White Paint, Traffic

	<u>Pounds</u>
TiO <sub>2</sub> , Anatase, A-MO, Titanox	150
Talc, #55, Desert	200
Calcium Carbonate, Snowflake White, T-W	150
Lead Free Zinc Oxide, #417, Eagle Picher	50
Bentone 38, National Lead	2
Traffic Alkyd, 50% Solids	495
6% Cobalt Drier	3
24% Lead Drier	6
Anti-Skinning Agent, Exkin	2
VM&P Naphtha	80
Butyl Alcohol	1
	<u>1139</u>

Grind: 4 Min.

Consistency: 72 to 82 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

WBB-9b White Binder, Bead

	<u>Pounds</u>
<del>TiO<sub>2</sub>, Rutile, R-900, DuPont</del>	<del>650</del>
<del>Ultramarine Blue, 59-5350, American Cyanamid</del>	<del>1</del>
<del>Long Oil Alkyd Resin, 70% Solids</del>	<del>560</del>
<del>6% Cobalt Drier</del>	<del>6</del>
<del>6% Manganese Drier</del>	<del>1</del>
<del>6% Zirco Catalyst</del>	<del>8</del>
<del>Anti-Skinning Agent, Exdin</del>	<del>6</del>
<del>Pine Oil</del>	<del>6</del>
<del>Zinc Resinate, Zinol, Newport</del>	<del>30</del>
<del>Mineral Spirits</del>	<del>15</del>
<del>Toluene</del>	<del>15</del>
<del>PMO, 10% Metal</del>	<del>5</del>
	<u>1303</u>

~~Grind: 7 Min.~~

~~Consistency: Semi-Paste~~

~~Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight~~

~~SEE SPECIAL PROVISION #2 9~~

YBB-9b Yellow Binder, Bead

	<u>Pounds</u>
<del>Light Chrome Yellow, X-2548, Imperial</del>	<del>500</del>
<del>Long Oil Alkyd Resin, 70% Solids</del>	<del>670</del>
<del>Zinc Resinate, Zinol, Newport</del>	<del>30</del>
<del>24% Lead Drier</del>	<del>10</del>
<del>6% Cobalt Drier</del>	<del>3</del>
<del>Pine Oil</del>	<del>6</del>
<del>PMO, 10% Metal</del>	<del>5</del>
	<u>1224</u>

~~SEE SPECIAL PROVISION #9~~

~~Grind: 7 Min.~~

~~Consistency: Semi-Paste~~

~~Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight~~

BBT-9 Bead Binder Thinner

	<u>Pounds</u>
Methyl Isobutyl Ketone	50
Mineral Spirits	50
	<u>100</u>

#701b Field Coat, Green

*See Special Provision # 10*

	<u>Pounds</u>
Zinc Yellow, X-2867, Imperial	250
Graphitic Mica, Micalith G	180
Red Lead, 97%, Hammond	60
Aluminum Paste, #205, ALCOA	40
Bentone 38, National Lead	5
Butyl Alcohol	2
Raw Linseed Oil	85
Modified Linseed Oil, Cykelin Z-3, Spencer-Kellogg	250
6% Cobalt Drier	6
Mineral Spirits	240
Anti-Skinning Agent, Exkin	4
	<u>1182</u>

Grind: 4 to 5

Consistency: 60 to 70 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

#716 Shop Coat, Special

	<u>Pounds</u>
Zinc Yellow, Y-539-D, DuPont	175
Blue Lead, Eagle Picher	160
Graphitic Mica, Micalith G	300
Red Lead, 97%, National Lead	100
Bentone 38, National Lead	3
Butyl Alcohol	2
Raw Linseed Oil	50
Modified Linseed Oil, Admerol 75, ADM	360
24% Lead Drier	10
6% Manganese Drier	5
Anti-Skinning Agent, Exkin	4
Mineral Spirits	160
	<u>1329</u>

Grind: 4 to 5

Consistency: 90 to 100 KU

Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight



#702 APE-1 Aluminum Paint, Exterior

	<u>Pounds</u>
Solid Petroleum Resin, Neville LX-685	120
Polymerised Linseed Oil, OXO S-70	300
Aluminum Lining Paste, #30, Reynolds	170
6% Cobalt Drier	2
6% Manganese Drier	2
6% Zirco Catalyst	2
Xylol	100
Mineral Spirits	<u>150</u>
	846

Consistency: 30 to 35 sec. at 75 grams, Stormer  
Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

Moisture: Throughout manufacture, every precaution shall be taken to prevent moisture contamination; batches shall be agitated no longer than necessary for complete mixing so as to avoid moisture from entrained air.

#802 APE-2 Aluminum Paint, Exterior (Fast Dry)

	<u>Pounds</u>
Acryloid B-66, 100% Solids, Rohm & Haas	160
Aluminum Paste, #205, ALCOA	160
Xylol	<u>500</u>
	820

Consistency: 27 to 32 sec. at 75 grams, Stormer  
Gallon Weight:  $\pm$  .05 lb. of theoretical gallon weight

Moisture: Throughout manufacture, every precaution shall be taken to prevent moisture contamination; batches shall be agitated no longer than necessary for complete mixing so as to avoid moisture from entrained air.

NOTE: Special Provisions 1-12 are no longer applicable.

SPECIAL PROVISION NO. 13

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. GENERAL: This Special Provision is a part of Texas Highway Department Special Item D-9-1, 11-64 and all requirements of that specification shall apply to this Special Provision.
- II. RAW MATERIALS: As listed in Texas Highway Department Special Item D-9-1, 11-64 and Special Provision No. 4 to that specification.

A. Epoxy Resin

1. Solid Resin Basis:
- |  |                     |
|--|---------------------|
| Epoxide Equivalent                     | 450 to 525          |
| Weight per gallon                      | 10.05 $\pm$ .05 lb. |
| Melting Point, Durrans' mercury method | 65 to 75°C          |
| 40% weight solution in Butyl Carbitol  |                     |
| Color, Gardner                         | 4 max.              |
| Viscosity, Gardner - Holdt             | D to G              |
2. 75% Resin Solution Basis:
- |                    |                                  |
|--------------------|----------------------------------|
| Color, Gardner     | 5 max.                           |
| Viscosity, Gardner | Z <sub>1</sub> to Z <sub>6</sub> |
| Epoxide Equivalent | 450 to 525                       |
| Weight per gallon  | 9.05 $\pm$ .05 lb.               |
| Type Solvent       | Xylene                           |

B. Polyamide Resin

1. Solid Resin Basis:
- |                           |              |
|---------------------------|--------------|
| Amine Value               | 203 to 223   |
| Viscosity, Poises at 75°C | 32 to 38     |
| Weight per gallon at 25°C | 8.15 to 8.25 |
| Flash Point °C, ASTM D92  | 290 min.     |
2. 70% Resin Solution Basis:
- |                                  |              |
|----------------------------------|--------------|
| % Solids                         | 69.0 to 71.0 |
| Weight per gallon                | 7.75 to 7.85 |
| Amine Value                      | 142 to 156   |
| Color, Gardner                   | 12 max.      |
| Viscosity, 25°C, Gardner - Holdt | V to Z       |
| Solvent                          | Xylene       |

### III. FORMULAE:

#### YEE-5, Yellow Epoxy Enamel

	<u>Pounds</u>
Base; Part A	
Medium Chrome Yellow, DuPont, Y-469-D	300
Yellow Iron Oxide, Pfizer, YLO-1788	14
Epoxy Resin Solution, 75%, Shell, 1001-X-75	345
Bentone 38	6
Methyl Isobutyl Ketone	105
Butyl Cellosolve	<u>105</u>
	875

#### Catalyst; Part B

Polyamide Resin, General Mills, Versamid 115	140
Xylol	<u>60</u>
	200

Grind: Base - 7 min. Particles: 8 max.

Consistency:

Base: 60 to 70 KU

Catalyst: Gardner - Holdt, 25°C, V to Z

Gallon Weight:  $\pm$ .05 lb. of theoretical gallon weight for both  
Base and Catalyst.

#### Packaging:

Base: Exactly 8.75 lbs. of Base; Part A shall be packaged in  
each one-gallon can.

Catalyst: Exactly 2.0 lbs. of Catalyst; Part B shall be packaged  
in each quart can.

One can of Base and one can of Catalyst shall be packaged together  
in a carton.

Labeling: Each can and carton shall contain the following label:

"Thoroughly mix the Base; Part A before adding the Catalyst;  
Part B and thoroughly mix the combined Base and Catalyst.  
Mix a minimum of 30 minutes before using."

"The volume of the finished paint when the two parts of one  
kit are mixed together will be approximately one gallon."

"For smaller amounts, mix three parts by volume of the  
thoroughly mixed Base, Part A to one part by volume of the  
Catalyst; Part B."

NOTE: Special Provision No. 14 is no longer applicable.

TEXAS HIGHWAY DEPARTMENT

SPECIAL PROVISION NO. 15

TO

PAINT SPECIFICATION D-9-1, 11-64

Section X.C.1(c) Lead Free Zinc Oxide specification is voided and replaced by the following:

- c. Lead Free Zinc Oxide; shall meet Federal Specification TT-P-463a, Type I.

TEXAS HIGHWAY DEPARTMENT

SPECIAL PROVISION NO. 16

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. GENERAL: This Special Provision is a part of Texas Highway Department Special Item D-9-1, 11-64 and all requirements of that specification shall apply to this Special Provision unless specifically exempted or changed by this Special Provision.
- II. RAW MATERIALS: As listed in Texas Highway Department Special Item D-9-1, 11-64 and Special Provision Numbers 10 and 12 to that Specification.
- A. Chlorinated Paraffin; shall meet Federal Specification MIL-C-429C, Type I or II as specified in formulae.
- III. TINTING: For paints that require tinting to "Match Color Standard" the volume of tinting paste used shall not be greater than 2.0% of the paint volume, except in special formulae wherein a specific color of tinting paste is indicated to achieve color, the volume of the specified paste will not be considered as tinting paste. For paints that contain "black iron oxide" any black tinting required shall be done with a black iron oxide tinting paste.
- IV. FORMULAE:

#742e, Gray Finish Coat

	<u>Pounds</u>
Vinyl-Toluene/Acrylate Copolymer, VTAC-L, Goodyear	190
Chlorinated Paraffin, Type I, Chlorowax 40	60
Chlorinated Paraffin, Type II, Chlorowax 70	85
Titanium Dioxide, Rutile, Du Pont, R-960	175
Zinc Oxide, Lead Free, AZO-33	50
Diatomaceous Silica, Dicalite L	150
Bentone 38	3
Butyl Cellosolve	25
MIBK	80
Xylol	250
Dipentene	15
	<u>1083</u>

Consistency: 100-115 KU

Grind prior to Dicalite: 5 min.

Grind of finish paint: 2-3

Gallon Weight:  $\pm$ .05 lbs. of theoretical gallon weight

Color: Match Color Standard for Color Only

Gloss; 85°: 1.5 maximum

#744f, Green Finish Coat

	<u>Pounds</u>
Vinyl-Toluene/Acrylate Copolymer,	
VTAL, Marbon	190
Chlorinated Paraffin, Type I, Chlorowax 40	60
Chlorinated Paraffin, Type II, Chlorowax 70	85
Pure Chrome Oxide, G-7099, C. K. Williams	25
Zinc Yellow, Imperial, X-2127	50
Titanium Dioxide, Rutile, Du Pont, R-960	100
Black Iron Oxide, BK-5099, C. K. Williams	7
Diatomaceous Silica, Dicalite L	175
Bertone 38	3
Dipentene	15
MIBK	80
Xylol	255
Butyl Cellosolve	25
Phthalo Blue	*
	<u>1070</u>

Consistency: 95 to 110 KU

Grind prior to Dicalite: 4 min.

Grind of finish paint: 2-3

Gallon Weight:  $\pm$ .05 lbs. of theoretical gallon weight

Color: Match Color Standard for Color Only

Gloss; 85°: 1.5 maximum

\* A small amount of Phthalo Blue tinting paste is required to achieve color, approximately 10 lbs. per 100 gallons.



TEXAS HIGHWAY DEPARTMENT

SPECIAL PROVISION NO. 17

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. GENERAL: This Special Provision is a part of Texas Highway Department Special Item D-9-1, 11-64 and all requirements of that specification shall apply to this Special Provision unless specifically exempted or changed by this Special Provision.
- II. RAW MATERIALS: As listed in Texas Highway Department Special Item D-9-1, 11-64 and Special Provision Number 12 to Item D-9-1, 11-64.

A. Surface Active Oil

	<u>Min.</u>	<u>Max.</u>
Cloud Point, °F	44	48
Pour Point, °F	40	44
Free Fatty Acid, as oleic		2.0%
Iodine Number	60	70
Saponification Number	185	195
Flash Point, °F COC	390	
Fire Point, °F COC	420	
Color, NPA		2
Specific Gravity at 60°F	0.895	0.905
Viscosity ssu at 100°F	90	100

In addition to the above requirements, the Infrared Spectra shall match the spectra on file with the Materials and Tests Division of the Texas Highway Department.

B. Additives and Chemicals

To Section X-G add:

Rheox #1

### III. FORMULAE:

#### #710b Prime Coat

	<u>Pounds</u>
Zinc Yellow, Y-539-D, Du Pont	150
Red Lead, 97%, Hammond	50
Diatomaceous Silica, Dicalite "L"	100
Talc, #325, International	175
Aluminum Paste, #205, Alcoa	50
Modified Linseed Oil, Admerol 75, ADM	270
Drying Castor Oil Copolymer, Copolymer 186, Baker	100
Rheox #1, Baker	5
Dipentene	25
VM&P Naphtha	115
Butyl Cellosolve	50
6% Cobalt Drier	6
6% Manganese Drier	4
Zirco Catalyst	4
Anti-Skinning Agent (approximate)	4
	<u>1108</u>

Grind: 4 min. Particles: 8 max.

Consistency: 88 to 98 KU

Gallon Weight:  $\pm .05$  lbs. of theoretical gallon weight

Skinning: No skinning within 48 hours

Sag: 8-B max., Test Method Tex-812-B, 24 hours

Moisture: Throughout manufacture, every precaution shall be taken to prevent moisture contamination.

#### #720d Rust Inhibiting Coating

	<u>Pounds</u>
Zinc Yellow, X-2127, Imperial	200
Red Lead, 97%, Eagle-Picher	50
Zinc Oxide, Lead Free, AZO-33, American Zinc Sales	100
Talc, #325, International	200
Aluminum Paste, 5-302, Reynolds	100
Bentone 38	2
Butanol	1
Polymerized Linseed Oil, OKO-S-70, Spencer-Kellogg	195
Modified Linseed Oil, Admerol 75, ADM	15
Surface Active Oil, Noroil 45, Neatsfoot	20
Raw Linseed Oil	20
6% Cobalt Drier	5
24% Lead Drier	5
Dipentene	7
VM&P Naphtha	100
Anti-Skinning Agent (approximate)	4
	<u>1204</u>

Grind: 4 min. Particles: 8 max.

Consistency: 93 KU minimum

Gallon Weight:  $\pm .05$  lbs. of theoretical gallon weight

Skinning: No skinning within 48 hours

Sag: 8-B max., Test Method Tex-812-B, 24 hours

Moisture: Throughout manufacture, every precaution shall be taken to prevent moisture contamination.

#810b Prime Coat

	<u>Pounds</u>
Powder:	
Zinc Dust	1800
Liquid:	
Polyurethane Resin, 60% Solids in Mineral Spirits	470
Red Iron Oxide, R-2900, C.K. Williams	20
Thix-a-trol "ST", Baker	4
Lead Drier, 24%	5
Cobalt Drier, 6%	5
Calcium Drier, 4%	2
Anti-Skinning Agent (approximate)	4
VM&P Naphtha	120
Butyl Cellosolve	20
	<u>650</u>

\*Grind: (77°F) 4 min. Particles: 6 max. (Test Method Tex-806-B)

Consistency: 54 to 60 KU

Gallon Weight:  $\pm 0.05$  lbs. of theoretical gallon weight

Skinning: No skinning within 48 hours (Test Method Tex-811-B)

% Solids, Liquid: 46.5 to 48.0

Sag, liquid: 10-A max., (Test Method Tex-812-B)

Sag, complete paint: 11-C max., (Test Method Tex-812-B)

\*Note: Paint for grind test shall be cooled to 77°F and allowed to stand undisturbed for a minimum of ten (10) minutes prior to checking for grind.

Packaging: The liquid and zinc dust shall be packaged in a two-container kit. Containers shall be one gallon triple seal friction, paint cans. One container shall contain  $6.50 \pm 0.05$  lbs. of liquid. The other container shall contain  $18.0 \pm 0.2$  lbs. of zinc dust.\* One container of liquid and one container of zinc dust shall be packaged together in a cardboard shipping carton to form a kit.

\*Note: Care shall be taken in packaging of zinc dust to avoid contamination by moisture (see paragraph II.C.2 of Special Provision No. 10).

Labeling: A legible label containing the following mixing information shall be permanently affixed to each container and case.

"Thoroughly mix the liquid portion before pouring it into a suitable clean mixing container. While stirring the liquid, add the zinc dust slowly. Continue to stir until all the zinc dust is completely dispersed. If further thinning is needed, a small amount of aliphatic naphtha, aromatic naphtha or similar approved solvent may be used. Strain before using.

"The volume of the finished paint when the two parts of one kit are mixed together will be approximately 1-1/4 gallons. This will yield a theoretical coverage of about 1000 mil (dry) square feet.

"For smaller quantities of paint, use 1.0 parts of liquid to 2.8 parts of zinc dust (by weight)."

NOTE: Special Provision No. 18 is no longer applicable.

TEXAS HIGHWAY DEPARTMENT

SPECIAL PROVISION NO. 19

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. GENERAL: This Special Provision is a part of Texas Highway Department Special Item D-9-1, 11-64, and all requirements of that specification shall apply to this Special Provision unless specifically exempted or changed by this Special Provision.
- II. RAW MATERIALS: As listed in Texas Highway Department Special Item D-9-1, 11-64 and Special Provision Numbers 10, 12, and 16 to that specification.

A. Drying Castor Oil Copolymer, 85% Solids in Mineral Spirits.

	<u>Min.</u>	<u>Max.</u>
Color, Gardner (ASTM D-1544)	5	8
Viscosity (Gardner-Holdt) 25 C	2	24
Specific Gravity	.930	.945
Refractive Index	1.491	1.493
Saponification Number	162	172
Iodine Number	122	135
Nonvolatile	84	86

In addition to the above requirements, the infrared spectrum shall match the spectrum on file with the Materials and Tests Division of the Texas Highway Department.

B. Styrene Acrylate Copolymer

1. Resin

Form: Shall be white granular powder

	<u>Min.</u>	<u>Max.</u>
Specific Gravity	1.05	1.07

## 2. Solution in Xylol

Viscosity - Seconds, #4 Ford Cup

	<u>Min.</u>	<u>Max.</u>
40% N.V.	120	170
33-1/3% N.V.	40	70
30% N.V.	20	50

## 3. Film

A one mil dry film cast from a 30% solution in Xylol shall be colorless and transparent.

In addition to the above requirements, the infrared spectrum shall match the spectrum on file with the Materials and Tests Division of the Texas Highway Department.

III. TINTING: For paints that require tinting to "Match Color Standard", the volume of tinting paste used shall not be greater than 2.0% of the paint volume. For paints that contain "black iron oxide", any black tinting shall be done with black iron oxide tinting paste.

## IV. FORMULAE:

### BRES-2, Brown Sign Enamel

	<u>Pounds</u>
Brown Iron Oxide, Charles Pfizer, B-1593	140
Talc, International, Asbestine 325	100
Medium Oil Alkyd Resin, 50% solids	570
Bentone 38	3
Butyl Alcohol	1
24% Lead Drier	5
6% Cobalt Drier	3
6% Zirco Catalyst	3
Xylol	25
Mineral Spirits	80
Anti-Skinning Agent	<u>4</u>
	934

Consistency: 75-85 KU

Grind: 6 Minimum

Gallon Weight:  $\pm$ .05 lbs. of theoretical gallon weight

Color: Match color standard

Skinning: No skinning within 48 hours (Test Method Tex-811-B).

GES-2c, Green Enamel, Sign

	<u>Pounds</u>
Phthalocyanine Green, Sun Chemical Corp., Fastolux Green 264-0414	50
Light Chrome Yellow, Du Pont, Y-433-D	30
Titanium Dioxide, Rutile, Du Pont, R-900	30
Medium Oil Alkyd Resin, 50% Solids	610
Bentone 38	2
Butyl Alcohol	1
24% Lead Drier	6
6% Cobalt Drier	3
Anti-Skinning Agent	4
Mineral Spirits	65
Xylol	<u>30</u>
	831

Consistency: 68-78 KU

Grind: 7 min. Particles: 8 max.

Gallon weight:  $\pm 0.05$  lbs. of theoretical gallon weight

Color: Match color standard

Skinning: No skinning within 48 hours (Test Method  
Tex-811-B).

BRPS-4, Brown Paste, Stencil

	<u>Pounds</u>
Brown Iron Oxide, Charles Pfizer, B-1593	100
Talc, Whittaker, Clark & Daniels, #399	200
Dehydrated Castor Oil, G-H, Baker	150
Drying Castor Oil Copolymer, Copolymer 186, 85% in M.S., Baker	70
Long Oil Alkyd Resin, 70% Solids	245
Drier Preservative, Nuact Paste	15
Thix-a-trol "ST", Baker	35
24% Lead Drier	6
6% Cobalt Drier	3
6% Manganese Drier	3
Butyl Cellosolve	40
Kerosene	60
Mineral Spirits	60
Anti-Skinning Agent	<u>6</u>
	993

Grind: 6 min. Particles: 8 max.

Color: Match color standard

Consistency: Soft short paste, match standard

Gallon weight:  $\pm 0.05$  lbs. of theoretical gallon weight

Skinning: No skinning within 48 hours (Test Method  
Tex-811-B).



#742f, Gray Appearance Coat

	Pounds
Styrene/Acrylate Copolymer, Goodyear, CPR-5135	190
Chlorinated Paraffin, Type I, Diamond Shamrock Chlorowax 40	60
Chlorinated Paraffin, Type II, Diamond Shamrock Chlorowax 70	85
Titanium Dioxide, Rutile, Du Pont, R-960	175
Lead Free Zinc Oxide, ASARCO, AZO-33	50
Diatomaceous Silica, GREFCO, Dicalite WB-5	150
Bentone 38	3
Dipentene	15
Butyl Cellosolve	25
MIBK	80
Xylol	250
	<u>1,083</u>

Consistency: 95-105 KU  
Grind prior to Diatomaceous Silica: 5 Minimum  
Grind of finished paint: 2-3  
Gallon weight:  $\pm$ .05 lbs. of theoretical gallon weight  
Color: Match color standard  
Gloss, 85°: 1.5 Maximum  
Skinning: No skinning within 48 hours (Test Method  
Tex-811-B).

#744g, Green Appearance Coat

	Pounds
Styrene/Acrylate Copolymer, Goodyear, CPR-5135	190
Chlorinated Paraffin, Type I, Diamond Shamrock, Chlorowax 40	60
Chlorinated Paraffin, Type II, Diamond Shamrock, Chlorowax 70	85
Pure Chrome Oxide, Charles Pfizer, G-7099	25
Zinc Yellow, Imperial, X-2127	50
Titanium Dioxide, Rutile, Du Pont, R-960	100
Black Iron Oxide, Charles Pfizer, BK-5099	7
Diatomaceous Silica, GREFCO, Dicalite, WB-5	175
Bentone 38	3
Dipentene	15
Butyl Cellosolve	25
MIBK	80
Xylol	255
Phthalo Blue	*
	<u>1,070</u>

Consistency: 95-105 KU  
Grind prior to Diatomaceous Silica: 4 Minimum  
Grind of finished paint: 2-3  
Gallon weight:  $\pm$ .05 lbs. of theoretical gallon weight  
Color: Match color standard  
Gloss, 85°: 1.5 Maximum  
Skinning: No skinning within 48 hours (Test Method Tex-811-B).

\* A small amount of Phthalo Blue is usually required to achieve color.

#746d, Brown Appearance Coat

	<u>Pounds</u>
Styrene/Acrylate Copolymer, Goodyear, CPR-5135	190
Chlorinated Paraffin, Type I, Diamond Shamrock,	
Chlorowax 40	60
Chlorinated Paraffin, Type II, Diamond Shamrock,	
Chlorowax 70	85
Zinc Yellow, Imperial, X-2127	75
Red Iron Oxide, Charles Pfizer, R-2900	25
Brown Iron Oxide, Charles Pfizer, B-1894	40
Diatomaceous Silica, GREFCO, Dicalite WB-5	200
Bentone 38	3
Dipentene	15
Butyl Cellosolve	25
MIBK	80
Xylol	255
	<u>1,053</u>

Consistency: 95-105 KU

Grind prior to Diatomaceous Silica: 4 Minimum

Grind of finished paint: 2-3

Gallon weight:  $\pm$ .05 lbs. of theoretical gallon weight

Color: Match color standard

Gloss, 85°: 1.5 Maximum

Skinning: No skinning within 48 hours (Test Method  
Tex-811-B).

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

SPECIAL PROVISION NO. 20

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. GENERAL: This Special Provision is a part of Texas State Department of Highways and Public Transportation Special Item D-9-1, 11-64 and all requirements of that specification shall apply to this Special Specification unless specifically exempted or changed by this Special Provision.
- II. RAW MATERIALS: As listed in Texas State Department of Highways and Public Transportation Special Item D-9-1, 11-64.
  - A. Medium Chrome Yellow in YEE-6d must meet all requirements as set forth in Special Provision No. 4 of Item D-9-1, 11-64.
  - B. All raw materials used in P.V.A. Emulsion, tint base must come from the following list of approved materials. Any substitution must be approved by the Materials and Tests Engineer.
    1. Phenylmercuric Acetate, 18% metal.
      - a. Tenneco Chemicals, Inc., PMA-18
      - b. Troy Chemical Corp., Troysan PMA-30
    2. Hydroxy Ethyl Cellulose
      - a. Dow Chemical Co., Methocel J-12-HS
      - b. Hercules, Inc., Natrosol 250 MR
      - c. Union Carbide Corp., Cellosize QP-4400
    3. Diethylene Glycol Monoethyl Ether Acetate
      - a. Eastman Chemical Products, Inc., Ektasolve DE Acetate
      - b. Union Carbide Corp., Carbitol Acetate
    4. Wetting Agent (25%) - Rohm & Haas Co., Tamol 731 (25%)
    5. Isooctylphenyl Polyethoxy Ethanol - Rohm & Haas Co., Triton X-100
    6. Defoamer
      - a. Colloids, Inc., Colloids 677
      - b. Drew Chemical Corp. 913-BL
      - c. Diamond Shamrock Chemical Co., Nopco Div., Nopco NDW
      - d. Witco Chemical Corp., bālab 748

7. Titanium Dioxide, Rutile - Must meet ASTM D 476-73, Type IV
8. Polyvinyl Acetate Copolymer, 55% Solids
  - a. Air Products and Chemicals, Inc., Flexbond 315  
Air Products and Chemicals, Inc., Flexbond 860
  - b. Celanese Coatings Co., Celanese Resin Div., Poly-Tex 660
  - c. DeSoto, Inc., 290-G04
  - d. National Starch and Chemicals Corp., Resyn 2243
  - e. PPG Industries, Inc., RD641
  - f. Reichhold Chemicals, Inc., Walpol 40-124
  - g. Southern Polymers, Inc., SPI-100
  - h. Union Carbide Corp., Ucar-366
9. Lecithin, Water Dispersible
  - a. Central Soya Co., Inc., Centromix LP-100
  - b. Ross and Rowe, Inc., R&R 551

### III. FORMULAE:

#### YEE-6d, Yellow Enamel, Equipment

	Pounds
Medium Chrome Yellow, du Pont, Y-469-D	200
Molybdate Orange, du Pont, YE-698-D	3*
Yellow Iron Oxide, Charles Pfizer, YLO-2288	30*
Bentone 38, N. L. Industries	2
Butyl Alcohol	2
60% Traffic Alkyd	520
24% Lead Drier	2
6% Cobalt Drier	2
6% Zirco Catalyst	4
Anti-Skinning Agent	4*
Aromatic Solvent, SC-100	40
VM&P Naphtha	130
	939

\*Slight variations in amounts are permissible to achieve color and stability.

Grind: 7 minimum. Particles: 8 maximum (Test Method Tex-806-B)  
 Consistency: 55-65 KU  
 Gallon Weight: + .05 lbs. of theoretical gallon weight  
 Color: Match Color Standard (Spray-outs must be used)  
 Skinning: No skinning within 48 hours (Test Method Tex-811-B)

Paint, Polyvinyl Acetate (PVA) Emulsion, Tint Base, Interior and Exterior

	Pounds
Water (Palatable)	395
Phenylmercuric Acetate (18% Metal)	4
Hydroxy Ethyl Cellulose	5
Diethyl Glycol Monoethyl Ether Acetate	12
Potassium Tripolyphosphate	1
Wetting Agent (25%)	3
Isooctylphenyl Polyethoxy Ethanol	6
Ethylene Glycol	20
Defoamer	4
Titanium Dioxide, Rutile	200
Mica (325 mesh)	25
Talc (Magnesium Silicate)	125
Polyvinyl Acetate Copolymer, 55% Solids	325
Lecithin, Water Dispersible	2
	1127

Grind: 4 minimum. Particles: 8 maximum (Test Method Tex-806-B)

Consistency: 78-86 KU

Gallon Weight: + 0.10 lbs. of theoretical gallon weight

Set to Touch: 15 minutes minimum at 70-80°F

Dry Through: 60 minutes minimum at 70-80°F

Working Properties: The PVA paint shall brush easily and shall have good flowing, leveling, and spreading characteristics. It shall dry to a uniform, smooth finish free from streaking or sagging.

Odor: The paint shall have no offensive, disagreeable, or putrid odor during or after application.

Storage Stability: Paint shall not skin, gel, seed, thicken excessively, or cake in the original unopened containers for a period of six months from the date of shipment when stored at normal temperatures. At the end of this six-month period, it shall be readily redispersible to a uniform usable condition by stirring, and shall meet the drying time requirements of this specification.

NOTE: Special Provisions No. 21-23 are no longer applicable.

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

SPECIAL PROVISION NO. 24

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. General: This Special Provision is a part of the Texas State Department of Highways and Public Transportation Special Item D-9-1, 11-64, and all requirements of that specification shall apply to this Special Provision unless specifically exempted by this Special Provision.
- II. Raw Materials: As listed in Texas State Department of Highways and Public Transportation Special Item D-9-1, 11-64, and Special Provision No. 12.

A. Tri-butyltin Oxide (Intercede 340-A)

Appearance	yellowish liquid
Color (Gardner)	2 max.
Specific Gravity @ 20°C	0.915-0.945
Viscosity (G.H.)	A5-A4
Solubility	In aromatic and aliphatic hydrocarbons, alcohols, esters, ketones, oils, emulsifiable in water.

III. Formulae:

WTBE-1, White Tint Base Enamel

	<u>Pounds</u>
Long Oil Alkyd, 70% Solids	550
Mineral Spirits	60
VMSP Naphtha	65
Titanium Dioxide, Rutile, duPont, R-900	250
Tri-butyltin Oxide, Intercede 340-A, Interstab	10
Calcium Drier, 4%	4
Cobalt Drier, 6%	4
Manganese Drier, 6%	2
Zirconium Drier, 6%	6
Anti-Skinning Agent	4
Thix-a-trol "ST"	3-4*
	<u>958</u>

\*As required to achieve viscosity and sag control.

Grind: 6 min. Particles: 8 max.  
Consistency: 85-92 KU  
Gallon Weight:  $\pm$ .05 lbs of theoretical gallon weight  
Skinning: No skinning within 48 hours  
Sag: 0

MEBE-2, Medium Tint Base Enamel

	<u>Pounds</u>
Long Oil Alkyd, 70% Solids	550
Mineral Spirits	60
VM&P Naphtha	65
Titanium Dioxide, Rutile, duPont, R-900	100
Calcium Carbonate, Atomite	100
Tri-butyltin Oxide, Intercide 340-A, Interstab	10
Calcium Drier, 4%	4
Cobalt Drier, 6%	4
Manganese Drier, 6%	2
Zirconium Drier, 6%	6
Anti-Skinning Agent	4
Thix-a-trol "ST"	3-4*
	<u>908</u>

\*As required to achieve viscosity and sag control.

Grind: 6 min. Particles: 8 max.

Consistency: 85-92 KU

Gallon Weight:  $\pm$ .05 lbs of theoretical gallon weight

Skinning: No skinning within 48 hours

Sag: 0

MEBE-3, Neutral Tint Base Enamel

	<u>Pounds</u>
Long Oil Alkyd, 70% Solids	550
Mineral Spirits	60
VM&P Naphtha	65
Calcium Carbonate, Atomite	165
Tri-butyltin Oxide, Intercide 340-A, Interstab	10
Calcium Drier, 4%	4
Cobalt Drier, 6%	4
Manganese Drier, 6%	2
Zirconium Drier, 6%	6
Anti-Skinning Agent	4
Thix-a-trol "ST"	3-4*
	<u>873</u>

\*As required to achieve viscosity and sag control.

Grind: 6 min. Particles: 8 max.

Consistency: 85-92 KU

Gallon Weight:  $\pm$ .05 lbs of theoretical gallon weight

Skinning: No skinning within 48 hours

Sag: 0



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

SPECIAL PROVISION NO. 25

TO

PAINT SPECIFICATION D-9-1, 11-64

- I. General: This Special Provision is a part of the State Department of Highways and Public Transportation Special Item D-9-1, 11-64, and all provisions of that specification shall apply to this Special Provision unless specifically exempted or changed by this Special Provision.
- II. Raw Materials: As listed in State Department of Highways and Public Transportation Special Item D-9-1, 11-64.

A. Proprietary Materials:

Materials listed below must be similar and equal to the standard sample submitted to the State Department of Highways and Public Transportation by the manufacturer and approved by the State Department of Highways and Public Transportation prior to award of contracts for coatings in which the material is proposed for use.

1. Dark Brown Iron Oxide, Pfizer, B-7097.

III. Formulae:

DBE-1, Dark Brown Enamel

	<u>Pounds</u>
Dark Brown Iron Oxide, Pfizer, B-7097	100
50% Medium Oil Alkyd	635
Mineral Spirits	65
Soya Lecithin	2
Methyl Alcohol	2
Bentone 38	4
4% Calcium Drier	6
6% Cobalt Drier	2
6% Manganese Drier	1
6% Zircocatalyst	5
Anti-Skinning Agent	3
Total	825

Gallon Weight -  $\pm$ .10 lb of theoretical gallon weight

Viscosity - 67 - 82 KU

Grind - 7 min.

Set-to-touch - 1-2 hours

Dry Hard - 16 hours max.

Skinning - None within 48 hours in a 3/4-filled closed container

60° Gloss - 85 min.



UTAH DEPARTMENT OF TRANSPORTATION  
MATERIALS AND RESEARCH SECTION

757 West 2nd South  
Salt Lake City, Utah 84104

October 1, 1979

Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

The Utah Department of Transportation does not currently use zinc-rich paints or primers, neither inorganic or organic types.

We are sorry we do not have a copy of a specification which can be furnished to you as per your request.

Sincerely,

Edwin E. Lovelace  
Engineer of Materials & Research

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION  
SPECIAL PROVISION FOR  
NO. 4 PAINT--INORGANIC ZINC SILICATE

May 26, 1977

I. DESCRIPTION -

This specification covers a 2-component self-curing ethyl silicate vehicle type zinc silicate paint which, when mixed and applied in accordance with the attached special provisions for Section 414A, shall cure without the use of a separate curing solution and will meet service requirements for highway construction.

Paint shall be homogeneous, free of contaminants and a consistency suitable for use in the capacity for which it is specified. The paint shall be well ground and the pigment shall properly disperse in the vehicle according to the requirements of the paint. The dispersion shall be of such a nature that the pigment does not settle badly, does not cake or thicken in the container and does not become granular or curdled. Any settlement of pigment in the paint shall be a thoroughly wet and soft mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum resistance to the sidewise motion of the paddle across the bottom of the container. The manufacturer shall include in the paint the necessary additives for the control of sagging, pigment settling, leveling, drying, drier adsorption and skinning or other requisite qualities of a satisfactory working material. No mud cracking shall occur after application of the paint. The paint shall possess satisfactory properties in all respects which affect its application and curing.

II. COMPOSITION -

(a) PIGMENT:

COMPONENT A

The zinc portion shall be of a finely divided zinc powder containing a minimum of 94 percent metallic zinc and 93 percent total zinc by weight. There shall be a minimum of 14 1/2 pounds of zinc to 1 gallon of the mixed paint.

COMPONENT B

PARTICALLY HYDROLYZED ETHYL SILICATE VEHICLE

The ethyl silicate used in the hydrolysis reaction in the preparation of the vehicle shall contain at least 28 percent silicon dioxide.

(b) PIGMENTED VEHICLE PROPERTIES:

Pigment, percent by weight, minimum	11.0
Nonvolatile at 105° C percent by weight, minimum	30
SiO <sub>2</sub> percent by weight after pigment, removal minimum	11.0
Storage life of vehicle at 77° F, month, minimum	12
Weight per gallon, pounds, at 77° F, minimum	8.3

(c) PROPERTIES OF MIXED PAINT:

Weight per gallon, pounds	20.5 - 22.5
Viscosity, K.U. at 77° F, Maximum	70 - 90
Nonvolatile at 105° C percent by weight	79.5 - 89.5
Set to touch, minutes, maximum	10
Dry hard, hours, maximum	24
Pot life at 77° F, minimum, hours	6

(Continued)

NO. 4 PAINT--INORGANIC ZINC SILICATE (Cont.) - 2 -

Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating.

III. RESISTANCE -

Test panels shall be cleaned to meet Steel Structures Painting Council Specification, SSPC-SP10-63. A three mil. coating (dry thickness) shall then be applied to test panels. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

(a) Fresh Water Resistance :

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening when examined after 30 days.

(b) Salt Water Resistance:

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.

(c) Resistance to Elevated Temperatures and Thermal Shock:

Panels shall be exposed to a temperature of  $500^{\circ}\text{F}$  for one hour, then quenched immediately in  $65^{\circ}\text{F} \pm 5^{\circ}\text{F}$  water. Panels subjected to this test shall show no blistering or flaking of the coating.

IV. PACKING AND LABELING -

Inorganic zinc paint shall be packaged in two-compartment containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint, the lot number, date of manufacture and individual net weights of pigment and vehicle. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

V. APPLICATION -

The manufacturer's current printed instructions for application of inorganic zinc coating shall be submitted to the Department for review. The supplier of the paint shall furnish the services of a technically qualified individual who is acceptable to the Engineer and the manufacturer of the paint and who shall be available for consultation at the fabricating shop at such times as the Engineer may designate.

VI. SAMPLES -

Initial samples for tests shall be submitted to the Department's Chemistry Laboratory AT LEAST 45 DAYS in advance of anticipated need so that the necessary physical tests may be performed.

AD-A093 495

ARTECH CORP FALLS CHURCH VA  
REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS, (II)

F/6 11/3

SEP 79 F ORDWAY, M J HAMMELL

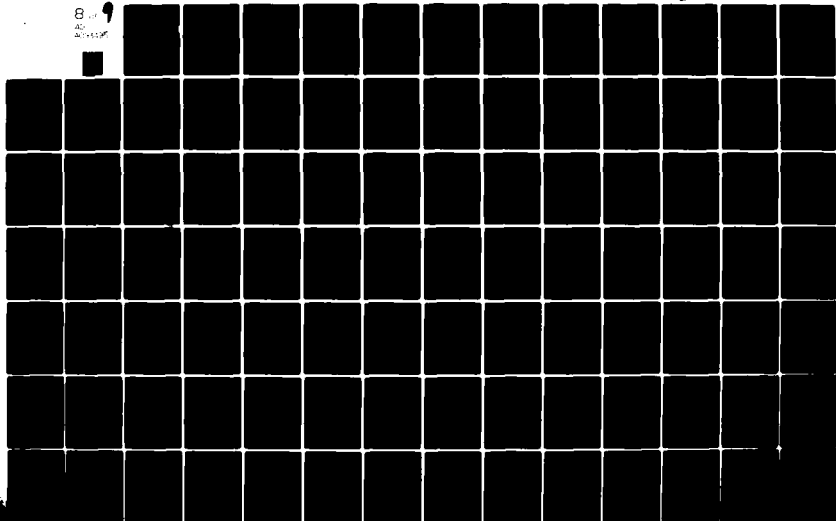
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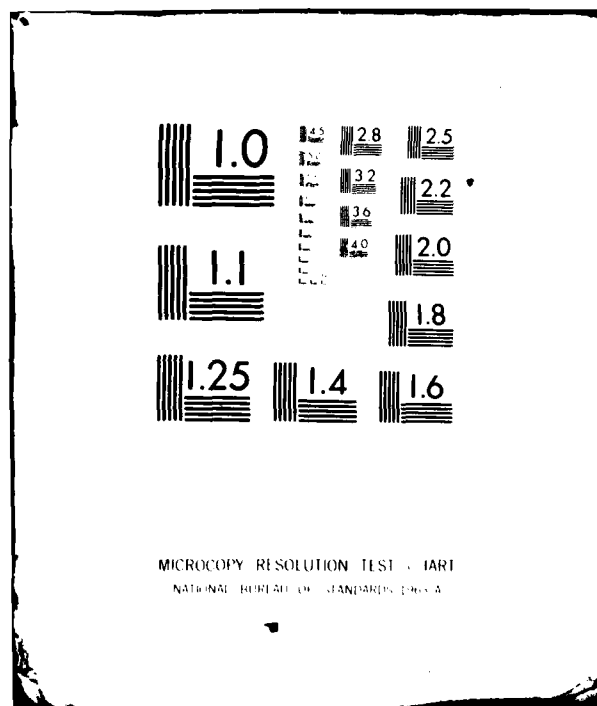
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STATE OF VERMONT  
DIVISION OF ENGINEERING AND CONSTRUCTION  
133 State Street, Montpelier, Vermont 05602



October 1, 1979

3 000 P.M.

VT. 3 1070

Mr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

The Vermont Agency of Transportation, Standard Specifications for Highway and Bridge Construction that you inquired about in your letter of September 19, 1979, contains the following items concerning Zinc or Zinc-rich paints and primers.

Section 708 - Paint Materials & Mixed Paints

708.01 Prime Coatings For Structural Steel and Other Metals.

- (d) VT 1.04 Zinc Chromate Primer. Zinc Chromate Primer is used as a prime coat on aluminum or steel surfaces and on weld areas in shop painting.

The primer shall conform to the requirements of Zinc Chromate-Alkyd Type Primer, Federal Specification TT-P-645.

- (e) VT 1.05 Zinc-Rich Primer. Zinc Rich Primer is used for the repair of damaged zinc coated (galvanized) surfaces.

The primer shall conform to the requirements of Military Specification MIL-P 21035.

- (f) VT 1.06 Zinc Dust - Zinc Oxide Primer.

Zinc Dust - Zinc Oxide Primer is used as a prime coat on zinc coated (galvanized) surfaces.

The primer shall conform to the requirements of Federal Specification TT-P-641, Type I or II.

Agency of Transportation  
Fred Ordway, Executive Vice President  
Artech Corporation

(g) VT 1.07 Basic Zinc Chromate - Vinyl Butyral Washcoat.


Basic Zinc Chromate-Vinyl Butyral Washcoat is used for pretreatment of blast cleaned structural steel surfaces prior to painting and on welded areas. It also is used as a pretreatment on galvanized steel surfaces prior to painting.

The washcoat shall conform to the requirements of Steel Structures Painting Council Specification PT 3-64.

I hope the above information will assist you in your specification comparisons. If I can be of further assistance, please let me know.

Very truly yours,

R. F. Nicholson, P.E.  
Materials & Research Engineer

By:   
Donald C. Brown, P.E.  
Chief Research & Testing Engineer



Washington State Highway Commission  
DEPARTMENT OF HIGHWAYS  
OLYMPIA, WASHINGTON

NOV. 25 1979

*Reprints from*  
WASHINGTON  
1977 STANDARD  
SPECIFICATIONS

Sec. 9-08	PAINTS .....	596-607
Sec. 9-21	LANE MARKERS .....	681-683
Sec. 9-23	CONCRETE CURVING MATERIALS AND ADMIXTURES .....	685-688
Sec. 9-26	EPOXY RESINS .....	691-695

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**Formula A-4-59—Phenolic-Red Lead Primer.**

The primer shall meet the requirements of Federal Specification TT-P-86, Type IV, Paint: Red-Lead Base, Ready Mixed. The viscosity of the finished paint shall be 80-90 K. U. at 70° F. and the Sag Index shall be 6 minimum.

**Formula A-5-61—Vinyl Pretreatment.**

The primer shall meet the requirements of Federal Specification M11-P-15328C Primer Pretreatment (Formula 117B for Metals).

**Formula A-6-61—Zinc Dust Zinc Oxide Primer.**

The primer shall meet the requirements of Federal Specification TT-P-641 Primer—Paint: Zinc Dust-Zinc Oxide Type II or Type III, except that the viscosity shall be 80-90 K. U. at 70° F. and the Sag Index shall be 6 minimum.

**Formula A-7-70—Shop Coat for Steel (Basic Lead Silico Chromate).**

This paint shall generally conform to Federal Specification TT-P-615, Type II. The characteristics of the paint shall be as follows:

Viscosity	80-90 K. U.
Weight per gallon (minimum)	13.4 pounds
Grind (N.S.) (minimum)	4
Drying time (for test purposes) (maximum)	18 hours
Sag index (minimum)	6

**Formula A-8-72—Shop Coat for Steel (Basic Lead Silico-Chromate).**

This paint shall generally conform to Federal Specification TT-P-615, Type IV. The characteristics of the paint shall be as follows:

Viscosity	80-90 K. U.
Weight per gallon (minimum)	13.2 pounds
Grind (N.S.) (minimum)	4
Drying time (for test purposes) (maximum)	6 hours
Sag index (minimum)	6

Test Requirements: Prior to manufacture.  
For complete characteristics see Federal Specification TT-P-615.

Paints

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**Formula A-9-73 Galvanizing Repair Paint, High Zinc Dust Content.**

The galvanizing repair paint shall meet the requirements of Federal Specification M11-P-21035 (Ship's) Paint, High Zinc Dust Content, Galvanizing Repair.

**Formula B-4-59—Phenolic First Field Coat for Steel.**

The phenolic first field coat for steel shall meet the requirements of Federal Specification TT-P-86, Type IV—Paint: Red-Lead-Base Ready Mixed—except that 0.4% of the red lead content shall be replaced with lampblack to give a resultant brown color. The viscosity of the finished paint shall be 80-90 K. U. and the Sag Index shall be 6 minimum.

**Formula B-7-70—First Field Coat for Steel (Basic Lead Silico Chromate).**

This paint shall generally conform to Federal Specification TT-P-615, Type II.  
Five pounds per 100 gallons (approximately 0.5 percent of the total formula weight) of the red iron oxide called for in Formula A-7-70 shall be replaced with lampblack to yield a brown color.  
Other than color, the characteristics of the B-7-70 shall be the same as listed for A-7-70.

**Formula B-8-72—First Field Coat for Steel (Basic Lead Silico-Chromate).**

This paint shall generally conform to Federal Specification TT-P-615, Type IV.  
Five pounds per 100 gallons (approximately 0.4 percent of the total formula weight) of the red iron oxide called for in formula A-8-72 shall be replaced with lampblack to yield a brown color.  
Other than color, the characteristics of B-8-72 shall be the same as listed for A-8-72.

**Formula C-6-59—Green Phenolic Finish Coat for Steel.**

Zinc chromate (dry pigment)	11.8 parts
Chromium green oxide (dry pigment)	16.1 parts
Titanium dioxide (dry pigment)	16.7 parts
Yellow iron oxide (dry pigment)	1.3 parts

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# Paints

Fibrous magnesium silicate (dry pigment)	5.0 parts
Aluminum stearate (dry pigment)	0.2 parts
Spar Varnish	22.1 parts
Raw linseed oil	21.4 parts
Driers	1.0 parts
Anti-skinning agent	0.1 parts
Mineral spirits	0.1 parts
Weight per gallon (minimum)	12.5 pounds
Viscosity at 70° F.	40-90 K.U.
Grind (minimum)	6
Set to touch	4 hours
Dry hard	18 hours
Sag Index	7 Min.

Test Requirements: Prior to manufacture.

Viscosity Adjustment: Mineral spirits to be added at the factory

to achieve the specified viscosity.  
The proportions of tinting pigments may be varied to achieve the desired color. The color of the paint when dry must match the color of a standard C-5 color chip. Additional tinting pigments may be required.

## Formula C-9-71—Steel Gray Phenolic Finish Coat for Steel (Plochere G-148).

Zinc Oxide (dry pigment)	21.0 parts
Titanium Dioxide (dry pigment)	21.0 parts
Fibrous magnesium silicate (dry pigment)	5.0 parts
Tinting Pigments	5.9 parts
Aluminum stearate (dry pigment)	0.2 parts
Raw Linseed Oil	14.5 parts
Spar Varnish	29.0 parts
Anti-Skin Agent	0.1 parts
Driers	1.0 parts
Mineral Spirits	2.3 parts
Weight per gallon (minimum)	13.0 lbs.
Viscosity	40-95 K.U.
Dry Hard (maximum)	18 hours
Set to Touch (maximum)	4 hours
Grind (N.S.) (minimum)	5
Sag Index (minimum)	7

Test Requirements: Prior to manufacture.

Adjustments for tinting pigments and tate, solvents and chemical additives shall be made at the factory to achieve the desire color and physical characteristics.

Color: Finished paint must match Plochere G-148 color (color samples are available from the Materials Laboratory).

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# Paints

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## Formula D-1-57—Aluminum Paint.

Aluminum paste Type 2 (Class B)	2.0 pounds
Spar varnish	1.0 gallon
Aluminum Paint shall be mixed on the job site, and only enough for one day shall be mixed at a time. The weighed amount of paste shall be placed in a suitable mixing container and the measured volume of vehicle then poured over it. The paste shall be incorporated by vigorous stirring with a paddle.	
Test Requirements: Prior to mixing:	

## Formula D-4-57—Black Enamel.

The enamel shall meet the requirements of Federal TT-E-529 Black Enamel, Synthetic, Semi Gloss.  
Test Requirements: This enamel will be sampled and tested in the ready-mixed form.

## Formula D-5-57—White Guard Rail Paint (Alkyd Vehicle).

Titanium dioxide (dry pigment)	28.1 parts
Zinc oxide (dry pigment)	10.9 parts
Fibrous magnesium silicate (dry pigment)	4.3 parts
Aluminum stearate (dry pigment)	0.5 parts
Alkyd vehicle	37.0 parts
24% lead naphthenate drier	0.2 parts
6% Cobalt naphthenate drier	0.2 parts
6% Manganese naphthenate drier	0.2 parts
Anti-skinning agent	18.2 parts
Mineral spirits	11.0 pounds
Weight per gallon (minimum)	40-90 K.U.
Viscosity at 70° F.	70-25
Nonvolatile content (minimum)	4
Grind (minimum)	30
Tinting power (maximum scale reading)	4 hours
Set to touch	18 hours
Dry hard	7 Min.
Sag Index	

Test Requirements: Prior to manufacture.

Viscosity Adjustment: Mineral spirits will be added at the factory to achieve the specified viscosity.

This formula is to be used over primed or previously painted surfaces.

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## Formula E-1-57—White for Wood Structures.

The material shall conform to Federal TT-P-102, Class A. Test Requirements: This paint will be sampled and tested in the ready-mixed form.

Primer: Turpentine may be added to the above paint in quantities not to exceed 1 1/2 pints per gallon of paint for use as a primer.

## Formula E-2-62—Primer for Wood.

The primer shall be a ready mixed priming paint for use over unpainted wood surfaces. It shall meet the requirements of Federal Specification TT-P-35 Primer, Paint, Exterior. Test Requirements: This paint shall be sampled and tested in the ready mixed form.

## Formula F-3-64—Orange Equipment Enamel.

The enamel shall meet the requirements for Enamel, Alkyd, Gloss, Federal Specification TT-E-489, except that the Sag Index shall be 7 minimum. The color, when dry, shall match that of Federal Standard No. 595, color 12246.

Test Requirements: When manufactured on Contract or Purchase Order for maintenance use, the enamel will be sampled and tested in the ready-mix form. No factory inspection will be required; however, a one-pint sample representing the batch must be submitted to the Materials Laboratory for approval before use.

For factory application to individual items of new equipment, samples of the enamel will not be required; however, the equipment manufacturer must match the color and certify the quality of enamel used.

## Formula H-1-57—Primer for Concrete.

Titanium calcium pigment	24.7 parts
Fibrous magnesium silicate	6.8 parts
Silica	6.8 parts
Spar varnish	32.3 parts
Mineral spirits	9.4 parts
Weight per gallon (minimum)	9.8 pounds
Drying time (for testing purposes only)	18 hours
Viscosity at 70% F.	65-75 K.U.

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# Paints

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Consistency: The paint shall not thicken after manufacture to an extent sufficient to impair its brushing qualities. Test Requirements: Prior to manufacture.

## Formula H-2-62—White Masonry Paint for Precast Curbs.

Titanium dioxide (dry pigment)	11.9 parts
Calcium carbonate (dry pigment)	35.6 parts
Mica (dry pigment)	7.4 parts
Diatomaceous silica (dry pigment)	7.0 parts
Thiox (body agent)	0.5 parts
Pluolite 55-A	8.0 parts
Chlorinated Paraffin 40%	4.0 parts
Chlorinated Paraffin 70%	4.0 parts
Aromatic brushing thinner	31.6 parts
Viscosity at 70% F.	90-100 K.U.
Weight per gallon (minimum)	12.1 pounds
Drying time (for test purposes only)	18 hours

Test Requirements: Prior to manufacture.

## Formulas J-1-68, J-2-68, J-3-68, J-6-68, J-7-68, J-8-68—Enamels for Signs.

Sign enamels are intended for application to wood, plywood, steel and aluminum surfaces, over a compatible primer. They shall be provided at a viscosity suitable for thinning for brush or spray application. The label shall state the thinner suitable for each purpose.

The enamels shall meet Federal Specification TT-E-489 "Enamel, Alkyd, Gloss." Colors for the various formula numbers are as follows:

J-1-68	White
J-2-68	Interstate Yellow
J-3-68	Black
J-6-68	Interstate Green
J-7-68	Interstate Blue
J-8-68	Interstate Red

## Formula J-4-57 Brilliant Green Sign Enamel.

This formula shall be a ready-mixed exterior paint meeting the requirements of Federal TT-P-71, except that a blend of titanium dioxide and tinting pigments shall be used instead of chrome green oxide. The paint shall match the color of a Standard Interstate Green. The paint, when reduced with an equal weight of linseed oil,

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*Paints*

shall have a hiding power of not less than 750 square feet per gallon when measured on the Plund Cryphotometer, Model E, white plate, viewed in a light of approximately 50 foot-candle intensity.

**Exterior Acrylic Latex Paint-White.**

This paint shall meet the requirements of Federal Specification T-1-P-19, Paint Acrylic Emulsion, Exterior, except that the viscosity shall be 75-85 K.U.

This paint may be used self-primed in multiple coats over salts treated wood and on interior and exterior masonry surfaces.

**Test Requirements:** This paint will be sampled and tested in the ready-mixed form.

**Traffic Signal Yellow Enamel.**

Traffic signal yellow enamel shall meet the provision of Federal Specification TT-E-489—Enamel, Alkyd, Gloss—and shall match the color of "Standard Intermediate Yellow."

**9-08.3 Inspection Requirements—General.**

Paints are classified into those requiring sampling and testing of raw materials prior to manufacture of the paint with inspection during manufacture, and paints which will be accepted on tests of the completely manufactured product. The type of test procedure required is indicated with the requirements for each formula under the heading "Test Requirements."

When the expression "prior to manufacture" is used in connection with a given formula, the manufacturer shall notify the Engineer when sufficient quantities of the necessary raw materials are on hand at the factory. The Engineer will then sample and seal each lot of material or request the manufacturer to do so, and the lots so sealed shall be reserved for use until the Engineer notifies the manufacturer of the acceptance of the lots sampled. The manufacturer shall certify that the paint was manufactured from the lots of raw materials so sampled.

The manufacturer shall notify the Engineer of the date on which manufacture will be started and the Engineer shall have the right to inspect all details of the manufacturing process and to assure himself that none but accepted lots of raw materials are used. The term "raw material" shall apply to each separate ingredient given in the formula except that varnish and single pigments ground to paste form in the specified vehicle shall be considered as "raw materials."

*Paints*

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Quantities of 20 gallons or less of the above formulas will be accepted without inspection upon the manufacturer's notarized certificate. This certificate shall contain a statement by the manufacturer to the effect that the material meets the formula specification, and shall include a list of materials and quantities used. One copy of the certificate shall accompany the paint when shipped and one copy with a sample of the paint shall be sent to the Materials Laboratory. The paint may be used at once without further release from the Materials Laboratory.

**9-08.4 Process of Manufacture.**

The following process of manufacture shall be used for each paint except aluminum paint. Pigments shall be ground thoroughly in appropriate portions of the specified vehicle to form a paste meeting the requirements set forth in Section 9-08.4(6) under "Fineness of Grinding." The grinding shall be done in a mill of a type approved by the Engineer. The use of the "colloid" type of mill will not be approved. Weighed quantities of the paste and weighed or measured quantities of the vehicles shall then be mixed thoroughly and strained, if necessary, to form a paint free from skins, lumps and foreign materials.

**9-08.4(1) Viscosity Adjustment.**

The volatile thinner content of the paint shall be adjusted at the factory to meet the required viscosity, but in no case shall the resultant weight per gallon and nonvolatile content of the paint be below that specified in the formula.

**9-08.4(2) Weight Variations.**

The weight per gallon of the paint in any lot shall not be less than that stated in the formula. A "lot" as used in this section shall be the quantity of paint ground at one time by any one mill.

**9-08.4(3) Drying Time and Quantity of Drier.**

The paint shall dry within the length of time stated in each formula but shall not contain sufficient quantities of drier to cause the paint to dry to a nonuniform or nonelastic film. The manufacturer will be permitted to vary the quantity of drier given in the formula sufficiently to accomplish the above results.

**9-08.4(4) Working Properties.**

The paint shall contain no caked material that cannot be broken

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### Paints

up readily by stirring. When applied to a clean vertical surface the paint shall dry without running, streaking or sagging.

#### 9-08.4(5) Storage Properties.

Paints manufactured under these specifications shall show no skin over the surface after 48 hours in a partially filled container, when tested as outlined in Federal Test Method Standard No. 141. A slight amount of skin or gel formation where the surface of the paint meets the side of the container may be disregarded. Variable percentages of "anti-skinning agents" are shown in those formulas set forth above that are susceptible to undesirable skin formation. The manufacturer will be allowed to vary the amount of "anti-skinning agent" given in the formulas provided the above results are accomplished and provided the paint does not dry to a nonuniform or nonelastic film.

#### 9-08.4(6) Fineness of Grinding.

The paint shall be ground so that all particles of pigment will be dispersed and be coated with vehicle, and the residue on a 325 sieve will not exceed 1 percent by weight of the pigment.

#### 9-08.4(7) Standard Colors.

When the paint is required to match a standard color, the manufacturer may obtain a sample of the required color without cost upon application to the Materials Laboratory, P.O. Box 167, Olympia, Washington 98504.

#### 9-08.4(8) Containers.

Each container shall be filled with paint and sealed airtight. Each container shall be filled with the amount of paint required to yield the specified quantity when measured at 70° F.

All paint shall be shipped in new suitable containers having a capacity not greater than 5 gallons. Each container shall be marked with a suitable number to identify the particular batch from which it was filled.

#### 9-08.5 Test Methods.

As set forth in Section 9-08.2, all paints shall meet the special requirements set forth for each formula. The test methods used to check those special requirements shall be as specified in the Washington State Highway Department Laboratory Manual, or the corresponding test method covered by Federal Specification TT-P-141.

### Paints

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When test methods are not covered by the above, applicable ASTM methods shall be followed.

#### 9-08.6 Shipping.

Except for lots of paint in quantities of 20 gallons or less which are accepted upon the manufacturer's certificate, the manufacturer shall not ship any lot of paint until the paint has been tested and/or released by the Washington State Department of Highways Materials Laboratory. This release will not constitute final acceptance of the paint. Final acceptance will be based on inspection or testing of job-site samples as determined by the Engineer.



State of Wisconsin \ DEPARTMENT OF TRANSPORTATION



DIVISION OF HIGHWAYS AND  
TRANSPORTATION FACILITIES

4802 Sheboygan Avenue  
P. O. Box 7916  
Madison, WI 53707

October 10, 1979

Dr. Fred Ordway  
Artech Corp.  
2901 Telestar Ct.  
Falls Church, VA 22042

CC-1 1979

Dear Dr. Ordway:

This letter is in reply to yours of September 19, 1979 regarding zinc-rich paints or primers.

Presently we do not have zinc rich paint in our standard specifications for use on steel structures. Recently we did use a zinc-rich paint system on the railing of a long bridge. The attached enclosure is a copy of the paint specifications as used on the project.

We would be interested in receiving a copy of your compilation of zinc rich paint specifications.

Sincerely,

*R. L. Musin*

R. L. Musin  
Field Materials Control Engineer

RLM:cm

Enclosure

Steel Railing, B-9-13 and Steel Railing B-9-979. The work under these items shall be in accordance with Section 513 of the standard specifications except as modified below.

The Steel railing shall receive a shop applied Zinc Rich Paint system. Paint materials used shall be compatible and from a single manufacturer. Tinting may be required if color differential between coats is hard to distinguish. Tinting shall be as recommended by the manufacturer. The final top coat shall not be tinted. The paint system may be one of the following or an approved equal, but the same system shall be used for all coats.

Kopper's Organic Zinc  
Mobil MZ5  
Jordan's Organic Zinc Rich

(1) Prime Coat. The prime coat shall be a one package, zinc-rich phenoxy binder for use on structural steel. This coating is intended for application by spraying and shall be shop applied.

(2) A Tie Coat as specified by the manufacturer of the primer used, will be required over the zinc rich primer. It is mandatory to use an undercoat for the vinyl paint system specified for the top coats. The Tie Coat shall be shop applied.

(3) The First Top Coat shall be high build vinyl paint for use on blast cleaned structural steel surfaces, primed with zinc-rich organic primer and treated with a vinyl primer or tie coat. The color shall be white. The first top coat shall be shop applied.

(4) The Second or Final Top Coat shall be a light blue vinyl paint. The contractor shall provide paint chips or color charts of available tints, for the system used, to the engineer for final tint selection. The final top coat shall be field applied. This coating may be applied by brushing or spraying. If spraying is used the contractor shall present his plan for containment of overspray, especially in areas over water, to the engineer.

(5) Application. Paint shall be applied in accordance with the manufacturer's recommendations in a neat, workmanlike manner.

Paint thickness shall be as follows:

<u>Min. Dry Film Thickness</u>	
Primer	2.0 - 3.0 mils
Tie Coat	1.0 mils
First Top Coat	4.0 mils
Second Top Coat	1.0 mils

Regardless of the method of application, the resultant paint film shall be smooth and uniform, without skips or areas of excessive paint.

Any painted areas on the railing damaged by transportation, handling and erection shall be cleaned and repainted as outlined above for the system used.

~~The beam guard rail attachment required at the south abutment of B-9-13, as shown on the plan, shall be steel plate beam guard, Class A, in accordance with Section 614 of the standard specifications.~~



## SECTION I

### Industry/Association Specifications

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4 OCT 1977

TENTATIVE SSPC SPECIFICATION SSPC-PS 12.01  
ONE-COAT ZINC-RICH COATING SYSTEM

1.1 This specification outlines a one-coat zinc-rich system to be used on steel in mild to moderately severe environments. This coating system is not recommended for environments where corrosive contaminants will have a pH below 5 or above 10.5, or severely corrosive environments. ~~where topcoating will be required~~

1.2 This specification defines the application and field performance requirements for a one-coat zinc-rich system, and should be used in conjunction with SSPC Paint Specification 20X which defines the minimum compositional and laboratory requirements for identifying zinc-rich coatings; and other SSPC Specifications covering surface preparation, application, thickness, inspection, and safety. If topcoating will be required (see Appendix 6.5 "Topcoating"), SSPC Specification 12.00 Revised "Guide to Zinc-Rich Coating Systems" should be consulted.

1.3 THIS SPECIFICATION DOES NOT PERTAIN TO WELDABLE PRE-FABRICATION ZINC RICH PRIMERS WHICH ARE APPLIED AT LOWER THICKNESSES (APPROXIMATELY 1 MIL OR LESS). FURTHER INFORMATION REGARDING THESE AND OTHER ZINC-RICH PRIMERS CAN BE FOUND IN SSPC SPECIFICATION 12.00 REVISED "GUIDE TO ZINC-RICH COATING SYSTEMS."

2. Description

2.1 This coating system consists of blast cleaning and one coat of zinc-rich paint. This class of coatings is uniquely defined by its capability of galvanically protecting steel exposed in discontinuities such as narrow scratches and holidays. This protective mechanism minimizes undercutting and pitting

attack. The system is recommended as a durable shop primer or as a protective one-coat system for normal atmospheric weathering environments and certain immersion services.

### 3. Requirements

The surface of the steel shall be cleaned and painted as follows:

3.1 Surface Preparation: While blast cleaning to a white metal (SSPC-SP5-63) is always preferred, this surface preparation is often difficult and expensive to achieve. A near-white metal blast cleaning (SSPC-SP10-63) or in some cases a commercial blast cleaning (SSPC-SP6-63) will often provide a satisfactory surface for these coatings. Although this specification is written for blast cleaned surfaces, under certain conditions pickling may also be used (see Appendix, paragraph A.4). However, the degree of deviation from the ideal which zinc-rich coatings will tolerate without serious loss of their properties varies considerably from coating to coating. Therefore, adequate instructions from the manufacturer are essential and must be closely followed to insure best performance.

3.1.1 Surface Conditions: The minimum surface cleaning for new steel shall be as specified in SSPC-SP6-63 "Commercial Blast Cleaning."

For previously painted or pitted steel, minimum surface cleaning shall be as specified in SSPC-SP10-63 "Near-White Blast Cleaning."

If any rust forms, or if the steel surface is otherwise contaminated after blast cleaning, the surface shall be recleaned prior to painting.

3.1.2 Surface Preparation for Exposure Conditions: A general guideline for surface preparation is as follows:

Exposure	Recommended Minimum Surface Preparation
(Immersion) - Continuous immersion or condensation	SSPC-SP5-63 "White Blast Cleaning"
(Splash/Spillage) - Frequent condensation splash, spray, spillage, and high fume concentrations	SSPC-SP5-63 "White Blast Cleaning"
(Chemical Fume) - Relatively high fume concentrations, no splash	SSPC-SP10-63 "Near-White Blast Cleaning"
(Atmospheric) - Non-corrosive fume concentrations and outside weathering	SSPC-SP6-63 "Commercial Blast Cleaning"

3.1.3 Profile: The nominal blast profile should be within the range of 1-1/2 to 3-1/2 mils.

3.2 Pretreatment: No pretreatment of the blast cleaned steel shall be required or permitted.

3.3 Application: Zinc-rich coatings are preferably applied by spray due to the advantages of this method, but some may be roller coated, or brushed to force paint into surface irregularities. During application, frequent mixing of the paint is essential to insure uniform pigment suspension, and when applying by spray method, use of a continuously agitated pot is recommended. Inorganic zinc-rich primers should not be applied by brush. Paint suppliers recommendations should be followed.

3.3.1 Primer: Only one coat of zinc-rich paint (SSPC Paint 20X) of either Type I (inorganic) or Type II (organic) shall be required.

3.3.2 Alternate Primers: None

3.3.3 Drying: Painted members shall be allowed to dry-through before handling or shipment.

If the coating has not dried tack-free within 24 hours, consult the paint supplier for specific instructions.

3.3.4 Touch-Up Painting: Touch-up field painting shall be performed in accordance with SSPC-PA-1-64 ("Shop, Field, and Maintenance Painting"), and in particular with Section 3.5.3 thereof entitled "Field Painting." Unless otherwise specified, touch-up painting shall be done in the field with a compatible organic zinc-rich.

3.3.5 Paint Film Thickness: The dry film thickness of the paint shall not be less than 2.5 mils. For magnetic gages, thickness shall be measured in accordance with SSPC PA 2-73T "SSPC Method for Measurement of Dry Paint Thickness with Magnetic Gages."

In the event the required paint film thickness is not achieved as specified for Type II primers (organic), additional coats shall be applied until the required thickness is obtained. For Type I primers (inorganic), the coating manufacturer should be consulted. In the event of mudcracking or loss of adhesion, the non-adherent zinc-rich coating shall be suitable removed and re-applied.

3.3.6 Workmanship: Paint shall be applied in a workmanlike manner in accordance with SSPC-PA1-64 ("Shop, Field, and Maintenance Painting").

3.3.7 Mixing: The mixing of a multi-package zinc-rich coating should be as follows: pour the fluid vehicle into the mixing container and agitate until homogeneous. Sift in the zinc powder in small quantities, mixing it in thoroughly. Mix until the powder is well dispersed. Pass the mixture through a 30 mesh screen to remove any lumps. When spraying, it is also good practice to use a 30 mesh in-line screen at the paint intake.

3.4 Field Performance: The following in-service field exposure or application histories shall be required:

1. From the Coating Supplier - A three year minimum case history of satisfactory service in an environment similar to that intended, is required. The names and addresses of previous users who can give information regarding coating service performance must be included. The specifier shall determine the applicability of this data for his specific use.
2. From the Coating Applicator - The names and addresses of responsible company officials for whom applicator has done coating work. References should include a recent job, and a job where a zinc-rich primer had been applied. The user shall determine the applicability of this data for his specific use.

3. Additionally, or in lieu of suitable in-service field exposure or application histories as described above, the coating supplier, coating applicator, and user shall establish a criterion of performance agreeable to all parties.
4. Additional requirements may be agreed upon by each of the parties.

SUMMARY OF SSPC PAINT SPECIFICATION 12.01

<u>Section</u>	<u>Item</u>	<u>Specification</u>
3.1	Surface Preparation	Minimum: SSPC-SP6-63
3.2	Pretreatment	None required or permitted
3.3	Paint Application	SSPC-PA 1-64
3.3.1	Number of Coats	One
3.3.1	Paint Material	SSPC-Paint 20X Type I Inorganic or Type II Organic
3.3.4	Touch-Up	As required herein
3.3.5	Dry Film Thickness	Minimum 2.5 mils - Maximum 5.0 mils SSPC-PA 2-73T

4. Inspection

4.1 All work and materials supplied under this specification shall be subject to inspection by the owner or his representative. The contractor shall correct such work or replace such materials as found defective under this specification. If the contractor does not agree with the inspector, the arbitration or settlement procedure established in the contract, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

4.2 Samples of paints used under this system may be required by the owner and if so, shall be supplied upon request along with the supplier's name and identification for the materials.

4.3 Unless otherwise specified, the methods of sampling and testing should be in accordance with Federal Test Method Standard No. 141a, or applicable methods of the American Society for Testing and Materials.

4.4 The contract covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

## 5. Safety

5.1 Paints supplied under this specification may, in some instances, contain highly flammable solvents whose vapors <sup>AND DUST</sup> are toxic. They may also contain other ingredients which are irritating to the skin or eyes. They should not be processed or applied near an open flame. When being applied in <sup>A</sup>closed space, sufficient ventilation should be provided to insure that the vapor does not reach explosive <sup>or Toxic</sup> concentrations. Workmen should avoid breathing ~~its~~ vapors and be extremely careful not to get any of the paint into their eyes. Prolonged contact of the paint with the skin should be avoided. Paint sprayers, in addition to wearing protective clothing and gloves, should wear an air-fed hood when and if the solvent-containing materials are applied.



5.2 Container labels and application instruction shall conform to suggested wording of the Manufacturing Chemists Association publication "Guide to Precautionary Labeling of Hazardous Chemicals", or existing Government Regulations.

5.3 Paint supplied in accordance with this specification does not necessarily comply with Section K, Rule 66, Los Angeles County Air Pollution Control District or other air pollution control requirements.

5.4 Application and safety instructions, requirements, precautions, and limitation included in SSPC-PA1-64, Section 4, "Safety Precautions" are considered a part of this specification and as such should be fully enforced.

5.5 All safety requirements shall be considered to supplement any federal, state, and local safety codes applying to any particular project, especially those pertaining to ventilation, respirators, sparks, welding, etc., and smoking.

~~The requirements of the Department of Labor "Safety and Health Regulations for Construction" and the Williams-Steiger "Occupational Safety and Health Act of 1970" shall apply, when required, to all work done under this specification.~~

#### Appendix

A.1 Scope: The recommendations contained in this Appendix are believed to represent current good practice, but are not considered as requirements of this specification.

A.2 Manufacturer's Literature: This specification is intended to be supplemented by the coating manufacturer's instructions and literature. If the manufacturer's literature or recommendations are to become part of the requirements of a contract, they must be submitted as part of the design, or bidding document. The date of the manufacturer's literature and the number of sheets should be listed. In the event of a conflict between the manufacturer's written instructions and this specification, the specifier, or other appropriate authorities, shall be notified to provide clarification.

A.3 Maximum Thickness: Because of the high pigment content of zinc-rich primers, and their tendency to "mudcrack" at excessive thicknesses, it is recommended that zinc-rich coatings not be applied to dry film thicknesses greater than 5 mils per coat.

A.4 Pickling: Pickling can be used for Type IC (solvent base inorganic) and Type II (organic) zinc-rich primers if agreed upon by the specifying parties. The pickling procedures shall be in accordance with SSPC-SP8 procedure 3.1.2.1. Specifically, this requires adequate rinsing of all pickling residues with 140°F hot water, and prohibits subsequent phosphoric acid or dichromate immersion.

A.5 Faying Surfaces: Certain inorganic zinc-rich primers, when untopcoated, provide sufficient friction to allow their use on faying surfaces of high tensile bolt connections. The

coating manufacturer should be consulted regarding the suitability of a zinc-rich primer for this purpose.

A.6 Quality Assurance: The user shall insure that coatings tested according to SSPC Paint Specification 20X will not be different than those actually applied at the jobsite. This assurance can be inexpensively obtained for vehicle components by obtaining infrared spectrographic curves from the laboratory test sample and comparing them with curves obtained from IR tracings of selected field samples. Pigment components may be similarly compared using atomic absorption or other spectrographic analyses. It is important that the same testing laboratory run all comparative analyses. If there is any significant difference between the tracings obtained from the laboratory and field coating samples, the coating manufacturer should be consulted. <sup>TOPCOATS MUST BE FORMULATED NOT ONLY FOR ENVIRONMENTAL RESISTANCE, BUT ALSO FOR SUITABLE APPLICATION (TO MINIMIZE TRIMMING, BUBBLING, ETC) OVER A ZINC-RICH PRIMER</sup>

A.7 Topcoating: Although not required by this specification, suitable topcoating will provide additional service life. In general, topcoating will be required in the more severe service environments. The following is a guide:

<sup>EXTREME CAUTION SHOULD BE EXERCISED WHEN USING ZINC-RICH</sup>  
~~Immersion - Zinc-rich coatings should not be used in~~  
~~coatings in conjunction with cathodic protection to protect steel in immersion.~~  
~~complete immersion when cathodic protection is used. For~~  
aqueous immersion service without cathodic protection they may be topcoated with a suitable topcoat. Zinc-rich coatings are satisfactory for many non-aqueous immersion services provided trace zinc contamination is not important. If contamination can occur, a suitable resistant topcoat may be employed.

Nov 2, 1977

Splash/Spillage - When coatings for appearance and protection of process equipment and structural materials are within a process area and exposed to process fumes and frequent splash and spillage of process chemicals, resistant topcoats may provide additional service life.

Chemical Fume - Coatings that are exposed to moderate and high concentrations of corrosive fumes and weather, but no splash or spillage, may be topcoated to provide additional service life.

Atmospheric - Coatings primarily for appearance in yard areas and service buildings—exposure to non-corrosive fumes and weathering only. Topcoating may provide additional service life, but zinc-rich primer alone is sufficient to provide ~~suitable~~ long-term protection.

A.8 Wet Abrasive Blast Cleaning: Dry abrasive blast cleaning may not be permitted in certain areas and wet abrasive blast cleaning may be an alternate.

A.9 Metric Equivalents: Some of the quantities appearing in this specification may not show metric equivalents, which include the following:

1 mil = 0.001 inches = 25.4 microns

1 inch = 1/12 foot = 25.4 mm = 2.54 cm

1 U.S. Gallon = 3.785 liters

1 pound = 16 ounces = 0.4536 kilograms

1 square foot = 0.0929m<sup>2</sup>

1 pound/inch<sup>2</sup> = 0.07031 kg/cm<sup>2</sup>

1 pound per U.S. Gallon = 0.1198 grams per cubic centimeter

100 square feet per Gallon = 2.454 square meters per liter

°F = 1.8 (°C) + 32

Since the equivalents are not exact, the SI (Metric) values are provided for information only, to familiarize readers with units that are expected ultimately to be adopted nationally.

7

TENTATIVE SSPC SPECIFICATION  
SSPC-PAINT 20X  
Type I Inorganic Zinc-Rich  
Type II Organic Zinc-Rich

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4 OCT 1977 M.

1. Scope

1.1 This specification covers a group of highly pigmented zinc-rich coatings that are uniquely defined by their capability of galvanically protecting steel exposed at discontinuities such as narrow scratches and holidays. These paints are intended for shop or field application, preferably by spray, directly over suitably cleaned steel surfaces.

1.2 This specification does not pertain to weldable pre-fabrication zinc-rich primers, which are applied at low thicknesses (approximately one mil or less). Further information regarding these and other zinc-rich primers can be found in SSPC Specification 12.00 Revised "Guide to Zinc-Rich Coating Systems."

1.3 This specification defines the minimum compositional and laboratory performance requirements for identifying a group of zinc-rich paints. It is to be used in conjunction with SSPC Specification No. 12.00 Revised (Guide to Zinc-Rich Coating Systems); SSPC-PS 12.01 (One Coat Zinc-Rich Paint System); and other SSPC specifications covering surface preparation, application, thickness, inspection, and safety.

1.4 While the major pigment component in this coating is zinc dust, the vehicle may be inorganic (Type I) or organic (Type II).

## 2. Description

2.1 The major pigment component in these coatings is zinc dust of the type described in ASTM Specification D-520 and Federal Specification TT-P-460. Other Pigment components may include curing aids, tinting colors, suspension and pot life control agents, but should constitute only a minor part of the total pigment portion so as not to detract from the ability of these coatings to protect galvanically.

2.2 Type I-A inorganic post-curing vehicles—water soluble, include alkali metal silicates, phosphates and modifications thereof which must be subsequently cured by application of heat or a solution of a curing compound.

Type I-B inorganic self-curing vehicles—water reducible, include water soluble alkali metal silicates, quaternary ammonium silicates, phosphates and modifications thereof. These coatings cure by crystallization after evaporation of water from the coating.

Type I-C inorganic self-curing vehicles—solvent reducible, include titanates, organic silicates, and polymeric modifications of these silicates. These systems are dependent upon moisture in the atmosphere to complete hydrolysis, forming the polysilicate.

2.3 Type II organic vehicles—include phenoxies, catalyzed epoxies, urethanes, chlorinated rubbers, styrenes, silicones, vinyls and other suitable resinous binders. The organic vehicles covered by this specification may be chemically cured or may dry by solvent evaporation. Under certain conditions heat may be used to facilitate or accelerate hardening.

### 3. Qualification Requirements

3.1 The following characteristics define the minimum compositional requirements of these zinc-rich paints without specifying the vehicle. Comments regarding these compositional requirements are presented in the Appendix, paragraph A.2

Characteristics	Minimum Requirements	
	Type IA, IB, IC Inorganic	Type II Organic
Total Solids, % by Weight of Paint (Federal Test Method Standard 141A Method 4041.1; ASTM D-2369).....	78	70
Pigment, % by Weight of Total Solids (FTMS 141A, Method 4021.1; ASTM D-2371)	85	83
Total Zinc Dust <sup>1</sup> , % by Weight of Pigment (FTMS 141A, Method 7221; ASTM D-521).	87	93
Total Zinc Dust <sup>1</sup> , % by Weight of Total Solids	74%	77%
Flash Point (Tag closed cup TTP-141a.4291; ASTM D-56) <sup>2</sup> .....	IA - none IB - none IC - 55°F (12.8°C)	50°F (10°C)

3.2 Packaging: The pigment portion of multi-component zinc-rich paints shall be packaged separately to be mixed with the liquid portion shortly before use. Each container of liquid shall be packaged and labeled in accordance with the requirements of Federal Specification TT-P-143 and shall include directions showing correct proportions of liquid and pigment and instructions for mixing as necessary. Packaging of single component zinc-rich paints, Types I and II shall also comply with the above Federal Specification.

<sup>1</sup>ASTM Specification D520 and Federal Specification TT-P-460.

<sup>2</sup>Specific applications, such as the interior of tanks and holds normally require a minimum flash point of 100°F.



3.3 Qualitative Paint Requirements: The paint shall meet the following qualitative requirements.

3.3.1 Mixing: The raw materials of the liquid portion of either the inorganic or organic multi-component paints shall be mixed and dispersed as required to produce a product which is uniform, stable, free from grit and conforms to the requirements of this specification.

The pigment portion of multi-component paints, prior to mixing, shall be dry and loosely packed.

The ready-mixed paint shall be capable of being broken up with a paddle to a smooth, uniform consistency and shall not liver, thicken, curdle, gel, or hard settle, nor show any other objectionable properties in a mixed, freshly opened container.

After mixing, all types of coarse particles and skins as residue retained on a standard 60 mesh screen shall be no more than 0.5% by weight of total paint, regardless of type, in accordance with ASTM D-185.

3.3.2 Pot Life: The pot life of the zinc-rich paint, when mixed and ready for application in accordance with manufacturer's instructions shall be a minimum of four hours at 70°F and 50% relative humidity. Although physical properties (viscosity, et.) may not change, loss of pot life is indicated by lack of adhesion when tested in accordance with paragraph 3.4.3. Good practice has been that multi-component zinc-rich paint be used within twelve (12) hours after mixing.

3.3.3 Storage Life: Neither the vehicle of the multi-component paint nor the ready-mixed paint shall show thickening, curdling, gelling, gassing or hard caking after being stored unmixed for six months from date of delivery in a tightly covered unopened container at a temperature of 50°F to 90°F.

3.3.4 Working Properties: The mixed paint shall spray easily, and show no streaking, running, sagging, or other objectionable features when tested in accordance with Federal Test Method Standard No. 141A, Methods 4331.1 and 4541.

3.4 Qualitative Film Requirements: The applied zinc-rich paint shall meet the following qualitative requirements.

3.4.1 Test Panel Preparation: Steel test panels (ASTM A-36 Hot Rolled Steel or equivalent) measuring 4" x 6" x 1/8" or greater, shall be white blast cleaned (SSPC-SP5) with a nominal anchor profile from 1-1/2 to 3-1/2 mils and coated (see Appendix, Paragraph A.4) with the zinc-rich paint. The paint shall be spray applied and hardened in accordance with manufacturer's recommendations. The dry film thickness will be 3 mils  $\pm$  1/2 mil unless otherwise designated. Prior to any exposure testing, all panels shall be aged for 14 days at 77°F (25°C) and 50% relative humidity.

3.4.2 Mudcracking: The coating when applied in accordance with 3.4.1, to a 5 to 6 mil dry film thickness, shall show no mudcracking when viewed under 10-X magnification.

3.4.3 Adhesion: The coating, when applied and hardened in accordance with Section 3.4.1, shall adhere to the steel substrate when subjected to the "cross-cut" adhesion test (ASTM D-3359).

Six or Eleven parallel cuts, depending upon coating thickness, approximately 1/10" apart are scribed through the coating into the steel substrate using a sharp knife. Perpendicular to these marks, another similar six or eleven cuts are made. The result is a cross-hatched field, composed of small squares, each side of which is approximately 1/10".

When 3/4" cellophane tape conforming to MIL-L-T-90c, Amendment 2, Type I Class A (#600 Scotch Brand cellophane tape or equivalent) is pressed firmly over the cross-hatched area and then pulled sharply off, at an angle perpendicular to the surface, there shall be no ~~loss of adhesion or separation of~~ the paint film, <sup>OR DELAMINATION OF AN ENTIRE SQUARE. SPALLING, LOSS OF ADHESION AROUND THE PERIMETER OF EACH SQUARE IS ACCEPTABLE.</sup>

3.4.4 Salt Fog Resistance: The coating, when applied in accordance with 3.4.1 and scribed as described below shall pass 1,000 hours minimum exposure to salt fog (ASTM B-117) without any blistering or rusting of the painted portion, and no under-cutting from the scribe. (Slight rusting in the scribe mark will be permissible and resulting staining should be ignored.) Strips 1/4" wide along the edges of the panel may be ignored. Testing shall be done in triplicate.

The scribe mark shall be centrally positioned in the lower half of the panel and shall consist of an "X" comprising the diagonals of a 2" x 2" square. To insure proper positioning, cleanliness and depth of scribe mark, template and scriber or cutting tool having a cutting edge 1/32" wide shall be used. The operator shall bear down hard and go over each arm of the

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The scribe mark shall be centrally positioned in the lower half of the panel and shall consist of an "X" comprising the diagonals of a 2" x 2" square. To insure proper positioning, cleanliness and depth of scribe mark, template and scriber or cutting tool having a cutting edge 1/32" wide shall be used. The operator shall bear down hard and go over each arm of the

cut twice to insure a clean scribe of sufficient depth to remove any zinc particles from the scribe and to expose clean steel.

3.4.5 Additional Resistance Tests: Additional screening qualification tests may be required by the user (see Appendix, paragraph A.7).

#### 4. Material Quality Assurance

4.1 The following tests shall be used to determine the acceptability of a lot or batch of a qualified product. The inspecting authority may require the testing of the material for compliance with any of the requirements of this specification, and may reject a lot or batch on the basis of any requirements in the specification.

4.1.1 Viscosity of the mixed paint shall be determined in accordance with Federal Test Method Standard 141A, Methods 4281 or 4282, or ASTM D-562. Variance shall be within  $\pm 5$  Krebs Units of the viscosity of the previously qualified paint.

For viscosities lower than 55 K.U., a #4 Ford Cup shall be used and variation shall be within  $\pm 5$  seconds of the viscosity of the previously qualified paint.

4.1.2 Weight per gallon of the mixed paint shall be determined in accordance with Federal Test Method Standard 141A, Method 4184.1. Variance shall be with  $\pm 0.4$  lbs. of the nominal weight per gallon of the previously qualified paint.

4.1.3 Solids percent by weight of the mixed paint shall be determined in accordance with Federal Test Method Standard 141A, Method 4041.1 or ASTM D-2369. The percent solids by weight

shall be no less than that specified in Section 3.1. Variance shall be within  $\pm 2\%$  of the nominal percent solids by weight of the paint of the previously qualified paint.

4.1.4 Other tests may be used to determine the acceptability of a lot or batch of a qualified product at the discretion of the user.

### Appendix

A.1 Scope: The recommendations contained in this Appendix are believed to represent current good practice, but are not to be considered as requirements of the specification.

A.2 Compositional Requirements: Paragraph 3.1 of this specification which defines the minimum compositional requirements of a zinc-rich paint is controversial. There are persuasive arguments for both raising or lowering these requirements, or deleting them altogether. This section is necessary as certain non-zinc containing coatings may be able to pass all other requirements of this specification. However, it is recognized that topcoated zinc-rich primers may perform satisfactorily at lower zinc loading levels due to the effect of the topcoat, ~~and that certain reputable coating manufacturers supply zinc rich coatings with lower zinc levels than the specified minimum~~

A.3 Coverage: Except for special cases, most zinc-rich primers are formulated to apply at a nominal dry film thickness of 2.5 to 3.5 mils. In actual practice a coverage of from

150  
200 to 300 square feet per gallon will be expected over flat

blast cleaned surfaces.

A.4 A SURFACE PROFILE COMPARATOR IS AVAILABLE FROM J.S.P.C. FOR SAND, GRIT AND SHOT BLASTED SURFACES. ALTERNATELY, REPUCE TAPE, DEPTH MICROMETER, STYLUS OR MICROSCOPIC MEASUREMENT METHODS OR OTHER SUITABLE TECHNIQUES MAY BE USED.

A.5 Inorganic zinc-rich paints Type IA and IB should not be stored at temperatures below 40°F. Furthermore, storage of all zinc-rich paints above 90°F should be avoided.

A.6 Inorganic zinc-rich primers (Type IA and IB) should not be applied at surface temperatures below 40°F. Type IC should not be applied at relative humidities below 50%, without specific instructions from the paint manufacturer.

A.7 Multiple component zinc-rich paints should be applied within four hours after mixing and should be continuously agitated during application.

A.8 Additional Resistance Tests: Because of the diversity of potential service environments, this specification may require the zinc-rich primer be further exposed and qualified by at least one additional test relating to the intended exposure. For example, if the intended service is a petroleum tanker cargo hold which is ballasted with sea water when empty, appropriate test requirements other than those already specified might be:

Salt Water Immersion (1,000 hours) FTMS 141a, Method 6011

Oil Immersion (1,000 hours) FTMS 141a, Method 6011

or a cycling combination of both. Comparative testing of all candidate zinc-rich primers will be more meaningful than individual testing of each primer.

Standard tests which may be useful for further qualification are available from a number of organizations, including ASTM, U.S. Government Federal Specifications (TT-P; MIL-P; etc.), Federal Test Method Standards (141a), and Canadian Government Specifications Board. A partial listing of public zinc-rich specifications requiring qualification testing is presented in the Appendix of SSPC-PS-12.00 "Guide to Zinc-Rich Coating Systems."

However, it should be emphasized that a well designed non-standard test may often provide more meaningful information for a given service condition than one or more standard tests.

**A.9 Metric Equivalents:** Some of the quantities appearing in this specification may not show metric equivalents, which include the following:

- 1 mil = 0.001 inches = 25.4 microns
- 1 inch = 1/12 foot - 25.4 mm = 2.54 cm
- 1 U.S. gallon = 3.785 liters
- 1 pound = 16 ounces - 0.4536 kilograms
- 1 square foot = 0.0929 m<sup>2</sup>
- 1 pound/inch<sup>2</sup> = 0.07031 kg/cm<sup>2</sup>
- 1 pound per U.S. gallon = 0.1198 grams per cubic centimeter
- 100 square feet per gallon - 2.454 square meters per liter
- °F - 1.8 (°C) + 32

Since the equivalents are not exact, the SI (Metric) values are provided for information only, to familiarize readers with units that are expected ultimately to be adopted nationally.



MAINTENANCE

1.0 Description

This Specification describes the surface preparation, coating system and application requirements for existing structural steel.

2.0 Surface Preparation

2.1 The steel shall be thoroughly cleaned of contaminants, either by hand-cleaning (SSPC-SP2-63) or power-tool cleaning (SSPC-SP3-63) or abrasive blast-cleaning (SSPC-SP7-63).

*brush of blast*

3.0 Coating System

3.1 The average dry film thickness of the one-coat self-priming system shall be no less than 5 mils D.F.T. This thickness shall be checked by the contractor in the presence, and to the satisfaction, of the Engineer.

3.2 The epoxy-bitumen shall also be compatible with a wide range of topcoats which may be required for colors other than aluminum.

4.0 Application

4.1 The epoxy-bitumen shall be applied in accordance with the manufacturer's printed instructions.

MODIFIED EPOXY-BITUMEN COATING1.0 Description

The modified epoxy-bitumen shall be a two-component epoxy-mastic of leafed Aluminum color. The epoxy-bitumen shall be designed as a one-coat high-build complete protective coating system with excellent adhesion to rusted steel and old coating systems after such surfaces have been cleaned to remove loose paint and loose rust by brush-off blast or other suitable methods. The epoxy-bitumen shall also be compatible with a wide range of topcoats which may be required for colors other than Aluminum. The epoxy-bitumen shall contain a rust inhibiting system which effectively controls undercutting of the paint film.

2.0 Composition2.1 Pigment

The primary pigment shall be of leafed Aluminum. Secondary pigments shall be of rust inhibiting and adhesion promoting types.

2.2 Vehicle

The vehicle shall be of the epoxy type modified with a bitumen oil and shall not contain coal tar. The curing agent shall have suitable insensitivity to moisture to allow trouble-free application during normal humidity conditions.

Vehicle Composition and Properties

The epoxy-bitumen shall contain 92%  $\pm$  2% solids by weight, tested according to ASTM D1644 modified to a dry time of 72 hours at 100°F rather than 3 hours at 105°C.

The shelf life of the epoxy-bitumen shall be no shorter than 12 months, so that no caking of fillers, skin, or gellation occurs.

Viscosity of catalyzed paint shall be 95-140 Ku at 77°F  $\pm$  2°F. Viscosity must be checked immediately after addition and mixing of catalyst.

Density: Component A shall be 9.5 to 10.7 pounds per gallon and Component B shall be 11.5-12.5 pounds per gallon, measured at 77°F  $\pm$  2°F.

Properties of Mixed Paint

- a) This finish coating system shall consist of a one-coat high-build modified aluminum epoxy-bitumen.
- b) The epoxy-bitumen shall display compatibility over properly prepared inorganic zinc primers.
- c) The epoxy-bitumen shall be leafed Aluminum in color. It shall be supplied as a two-package material with a one-to-one volume mix ratio, and shall be well ground and not caked, skinned or badly settled in the container.
- d) Film Build: The catalyzed mixture, thinned 10% by volume with the specified thinner, shall be spray-applied at 10 mils wet film thickness without exhibiting runs or sags and will yield 8 mils dry film thickness in one coat.
- e) The average dry film thickness of the product, applied in one coat, shall be no less than 5 mils. This thickness shall be checked by the Contractor in the presence of and to the satisfaction of the Engineer.
- f) The epoxy-bitumen shall not be applied when the surface temperature is below 40°F and shall not be applied when the temperature is expected to drop below 40°F before the coating has cured.
- g) The epoxy-bitumen shall air cure at a temperature of 75°F or above to a hard tough film within 5 days by evaporation of solvent and chemical reaction. It shall be dry to the touch in 24 hours at 75°F, and to receive foot traffic in 48 hours at 75°F.
- h) The pot life of the epoxy-bitumen shall be no shorter than 4 hours at 75°F or 2 hours at 90°F.
- i) Flexibility: Apply 5 mils D.F.T. of the epoxy-bitumen on a sandblasted steel panel, 1/8" x 30" x 4". Cure the coating for 2 weeks at 75°F. The coating shall show no signs of cracking or loss of adhesion after the panel is uniformly bent around on an 8" diameter mandrel. The panel shall be sandblasted in accordance with SSPC SP5 Specification.
- j) The mixed paint weight per gallon shall be 11.3 ± 0.5 pounds at 77°F ± 2°F.

### 3.0 Resistance

The epoxy-bitumen shall meet or exceed the following resistance requirements when applied in the manner indicated in Section (a) below on steel panels prepared according to Section (b) below.

- a) The epoxy-bitumen shall be spray-applied to the steel panels at 6 mils dry film thickness in one coat. The coating shall be cured as recommended by the manufacturer.
- b) The steel test panels, meeting the requirements of ASTM D609-61 (1968) having dimensions of 2" by 5" by 1/8", shall be prepared by sandblasting to a white metal in accordance with SSPC SP5 Specification. They shall then be exposed to the weather for 30 days so that a uniform rusting occurs. They shall then be hand-cleaned with a wire brush in accordance with SSPC SP2 Specification. The test panels shall then be coated and cured with the epoxy-bitumen as outlined above.

### 3.1 Fresh Water Resistance

The coated panels shall be scribed down to base metal with an X of at least 2" legs and shall be immersed in fresh tap water at 75°F ± 5°F.

Upon examination after 30 days immersion, the panels shall be unaffected except for discoloration of the epoxy-bitumen coating. There shall be no blistering, softening, or visible rusting of the coating beyond 1/16" from the center of the scribe mark.

### 3.2 Salt Water Resistance

Panels shall be scribed down to the base metal with an X of at least 2" legs and immersed in 5% sodium chloride solution at 75°F ± 5°F. The panels shall be unaffected except for discoloration of the epoxy-bitumen coating, upon inspection after 7, 14 and 30 days. There shall be no blistering, softening, or visible rusting of the coating beyond 1/16" from the center of the scribe mark. The sodium chloride solution shall be replenished with fresh solution after each examination.

### 3.3 Weathering Resistance

Panels shall be tested in accordance with ASTM G-23-69 Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel, or blistering.

### 3.4 Salt Fog Resistance

COPY

Panels shall be scribed with an X of at least 2" legs down to base metal. The test panels shall then be tested in accordance with ASTM B117-64. After 1000 hours to continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16" from the center of the scribe mark.

### 4.0 Packaging and Labeling

The epoxy-bitumen coating shall be packaged in 2 containers, labeled Part A and Part B. The components shall be packaged in such proportions that the Part A when mixed with the Part B will yield 10 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the manufacturer or a brand name of paint, the lot number and the date of manufacture. The label on the vehicle container shall also include complete instructions for the use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

### 5.0 Application

The manufacturer's current printed instructions for application of aluminum epoxy-bitumen coating shall be submitted to the Engineer for review and approval.

### 6.0 Manufacturer and Brand Name Approval

The manufacturer shall furnish reference and certify that the modified aluminum epoxy-bitumen has been used successfully for a period of at least five years in similar service and environment and that the material in such service was applied in one coat at a dry film thickness at 5 mils. Successful performance must include sustained adhesion to both steel and old coatings and must have sustained compatibility with suitable topcoats if required.

Prior to approval and use of any aluminum epoxy-bitumen finish coat, the manufacturer shall, if requested, submit a test report showing specific test results conforming to all quantitative and resistance test requirements of these specifications. In addition, the certified test report shall contain the lot numbers that all data is compiled from: the manufacturer's name, and brand name of paint. Upon approval of this test report, further resistance and quantitative tests will not be required of that manufacturer for that brand name of paint unless just cause is shown that the existing test report may be inaccurate. Just cause shall be considered as nonconformance of random samples, tested, to any of the requirements herein specified. The manufacturer shall, upon request, submit new certified test results any time the manufacturing process or the paint formulation is changed.

To obtain final acceptance of the epoxy-bitumen, the manufacturer shall, upon request, furnish a certification stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The right is reserved to sample and test any or all materials supplied.

NEW CONSTRUCTION

## 1.0 Description

This specification describes the surface preparations, coating system and application requirements for shop coating of structural and miscellaneous steel.

## 2.0 Surface Preparation

2.1 Solvent clean in accordance with SSPC-SPI to remove oil and grease contamination just prior to blast cleaning.

2.2 Blast surfaces in accordance with Steel Structures Painting Council Specification No. 6 "Commercial Blast Cleaning."

2.3 Anchor Pattern shall have a continuous etch with an average 1.5 mils depth.

2.4 Coat blasted surface immediately after cleaning.

## 3.0 Coating System

3.1 The shop Primer shall be as follows:

Inorganic Zinc Primer - 3 mils D.F.T.  
All surfaces of the structural steel shall be coated, including contact surfaces of high strength bolted connections and areas in contact with concrete.

3.2 The finish coat shall be applied in the field after touch up and shall be as follows:

High Build Vinyl - 3 mils D.F.T.

3.3 The vinyl paint for the finish coat shall be manufactured by the supplier of the inorganic zinc primer.

## 4.0 Application

4.1 Both the inorganic primer and vinyl finish coat shall be applied in accordance with the manufacturer's printed instructions.

INORGANIC ZINC SILICATE PAINT1.0 Description

The inorganic zinc silicate paint shall be a single or two-component self-curing type which, when mixed and applied in accordance with the manufacturer's instructions, cures without the use of a separate curing solution, and shall have the properties described herein.

1.1 The inorganic zinc silicate paint shall meet or exceed the requirements of Steel Structures Painting Council Specification PS 12.00. It shall also meet or exceed the requirements for use on contact surfaces of structural joints using ASTM A-325 or A-490 bolts.

2.0 Composition - Two Component2.1 Zinc Dust

The zinc component shall be a finely divided zinc powder containing, by weight, a minimum of 94 percent metallic zinc and a minimum of 98 percent total zinc. All other fillers contained in the zinc component shall be inert substances. No toning pigment should be included. The average particle size shall be 6-9 microns.

2.2 Base Component

The base component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate alcohol solvent.

## 2.3 Mixed Paint

### Properties of Mixed Paint

- (a) The total zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.
- (b) The total solids, when heated at 105°C for three hours shall be not less than 79 percent by weight.
- (c) The paint shall tolerate up to one percent water contamination by weight without gelation within 5 minutes.
- (d) The weight of zinc filler per gallon of mixed paint shall be 14.5 pounds maximum.
- (e) The usable pot life of the mixed paint shall be not less than eight hours at 77°F. There shall be no hard settling which cannot be easily redispersed during this period.
- (f) Weight per gallon, pounds at 77°F                      20.5 - 22.5
- (g) Mixing ratio of base component to zinc component by weight shall be 1.00:2.20.

## 3.0 COMPOSITION - Single Component

### 3.1 Zinc Dust

The zinc dust used in manufacture of the inorganic zinc silicate paint shall be a finely divided zinc powder containing, by weight, a minimum of 94% metallic zinc and a minimum of 98% total zinc. The average particle size shall be 6-9 microns.

### 3.2 Vehicle

The vehicle used in manufacture of the inorganic zinc silicate paint shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent blend. The SiO<sub>2</sub> weight percent of vehicle (without pigments) shall be 9-11.

### 3.3 Mixed Paint

- A. The total zinc portion shall be a least 85 percent by weight of the total solids of the dried coating.



- B. The total solids, when heated at 105°C for 3 hours, shall not be less than 73 percent by weight.
- C. The paint shall tolerate up to one (1) percent water contamination by weight without gelation within 5 minutes.
- D. The weight of zinc filler per gallon of mixed paint shall be 12.05 pounds minimum.
- E. The weight per gallon of the mixed paint shall be 18.5 -19.5 at 77°F.
- F. The theoretical coverage of the mixed paint shall be 900 mil ft. per gal.
- G. The viscosity shall be 90 KU minimum at 75°F.

#### 4.0 Color

The inorganic zinc coating (both single and two component) shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the vinyl finish coat. The color of the inorganic zinc primer shall be green.

#### 5.0 PACKAGING & LABELING

##### 5.1 Two Component

Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle, will yield five gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint and the lot number. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

##### 5.2 Single Package

Inorganic zinc paint shall be packaged in a 3 gallon container for ease of handling. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint and the lot number. The label on the container shall also include complete instructions for use of the paint. The container shall be coated if necessary to prevent attack by the paint components.

## 6.0 APPLICATION

The manufacturer's current printed instructions for application of inorganic zinc coating shall be submitted to the Highway Department for review and approval.

## 7.0 MANUFACTURER AND BRAND NAME APPROVAL

Prior to approval and use of any inorganic zinc, the manufacturer shall submit to the State Highway Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ratio by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the State Highway Department of this certified test report, further resistance tests will not be required, except as herein after noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the State Highway Department when random sampling and testing of material offered for use indicates nonconformance to any of the requirements herein specified.

To obtain final acceptance of the inorganic zinc, the manufacturer shall furnish a certification stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The State Highway Department reserves the right to sample and test any or all materials supplied.

### 7.1 Resistance

Test panels of steel meeting the requirements of ASTM D 609-61 (1968) having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces as designated in paragraph (a) below. A three mil coating (dry thickness) shall be applied to the test plates in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed. If any individual test panel fails any of the following tests, the material will not be accepted.

(a) Surfaces to be painted with inorganic zinc paint shall be blast cleaned with abrasives producing a nominal height of Profile of 1.5 mils. The blast cleaned surfaces shall meet SSPC-6 and the following requirements:

(1) All oil, grease, dirt, rust scale and other foreign matter shall be completely removed except as hereinafter modified.

(2) All rust, mill scale and old paint shall be removed.

7.2 Fresh Water Resistance

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at 75°F - 5°F. The panels shall show no rusting, blistering or softening when examined after 30 days.

7.3 Salt Water Resistance

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at 75°F - 5°F. The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

7.4 Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel or blistering.

7.5 Salt Fog Resistance

Panels shall be scribed with an X or at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

7.6 Resistance to Elevated Temperatures and Thermal Shock

Panels shall be exposed to a temperature of 500°F for one hour, then quenched immediately in 65°F ± 5°F water. Panels subjected to this test shall show no blistering or flaking of the coating.

VINYL FINISH COATING1.0 Description

The vinyl paint for the finish coat shall be manufactured by the supplier of the inorganic zinc primer. It shall display compatibility with and adhesion to the cured inorganic zinc paint when applied directly over the inorganic zinc paint in accordance with the manufacturer's current printed instructions.

2.0 Composition2.1 Vehicle

The vehicle shall consist essentially of vinyl chloride-copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

2.2 Mixed Paint

2.2.1 The vinyl paint shall conform to the following values.

	<u>Minimum</u>	<u>Maximum</u>
Percent pigment by weight	28%	--
Percent vehicle solids by weight	22%	--
Percent total solids by weight	50%	54%
Weight per gallon at 77°F	9#	11#

2.2.2 Vinyl paint shall be supplied in a single package. It shall be well ground and shall not be caked, livered, skinned, or badly settled in the container. All containers shall be cleaned of any paint spilled during filling operations. Containers shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, product number, color number, lot number, date of manufacture, shelf life, and complete instructions for their use.

2.3 Color

The color for the vinyl finish coat shall be as selected by the State Highway Department from Federal Standards No. 595a dated January 2, 1968.

# STEEL STRUCTURES PAINTING COUNCIL

## SPECIFICATION No. 12.00

### GUIDE TO ZINC-RICH COATING SYSTEMS

#### 1. SCOPE

1.1 This guide covers a group of coatings, typified by high zinc dust content, formulated to provide hard, tough, abrasion resistant protection to steel with varying degrees of rust inhibition by virtue of the galvanic protection provided by the zinc. These coatings may be used under normal inland conditions, but are mainly intended for use under conditions of high humidity or marine atmospheric exposures, both exterior and interior, and for fresh water immersion. They may, by proper topcoating, be used in brackish and sea-water immersion and for exposure to chemical (acid and alkali) fumes. These coatings normally require a near-white metal blast cleaned surface for best results and are usually applied in one coat 2 to 5 mil dry film thickness over the cleaned steel. Some are used as prefabrication primers or shop primers, often at lesser thicknesses, where they are applied to freshly blast cleaned steel plates and sections and are intended to protect the steel throughout the fabrication period until the final painting system can be applied to the finished structure.

#### 2. DESCRIPTION

2.1 Zinc-rich coatings comprise a number of different commercial types. These coatings may be composed of organic or inorganic vehicles. The organic vehicles used are chlorinated rubber, styrene, epoxies, polyesters, vinyls, urethanes, silicones and other suitable vehicles usually with a zinc dust content of 80 to 95% by weight of the total non-volatile content.

Among the inorganic vehicles used are silicates, silicate esters, phosphates, and modifications thereof usually with a zinc dust content upwards of 75% by weight of the total non-volatile content. The inorganic paints may be self-cured (converted or hardened to a state of water and solvent insolubility), or post cured with a separate wash solution, usually mildly acidic in nature applied as an aftercoat.

Many of the coatings are supplied with the zinc pigment packaged separately to be mixed at the time of application. Most coatings have a limited pot life which may be as low as six hours with some formulations.

2.2 For best results, these coatings should be used over near-white metal blast cleaned steel (SSPC-SP 10-63), although the degree of surface preparation required varies for specific coatings. Some coatings must be used only over the best surface preparation; others will tolerate somewhat lesser preparation; and still others, including many based on organic vehicles, will provide satisfactory performance under some conditions of mild service over no more than a good mechanically hand cleaned surface. Likewise, the degree of tolerance for high humidity, damp surface prior to application, moisture after application, temperature during application and the drying or curing period, varies considerably from coating to coating. Therefore, adequate instructions from the manufacturer are essential and must be closely followed to obtain best performance from these coatings.

2.3 These coatings vary in application characteristics. All are preferably applied by spray, but may be brushed for small jobs, or to force into surface irregularities. Due to the galvanic action of the zinc, these coatings can give satisfactory performance under mildly corrosive conditions with one coat application as little as 2 mils thick. Most of the coatings can be self-coated or topcoated with epoxies, vinyls, etc., immediately or at a later date, for better performance under more severe exposures. Special precautions in cleaning the prime coat prior to selfcoating or topcoating may be required.

Tie coats are necessary between some zinc rich coatings and some of the special topcoats. The importance of obtaining and following manufacturer's recommendations cannot be overemphasized.

2.4 Variations in properties of these coatings depend largely on the vehicle. All zinc-filled coatings, however, are unsuitable for acidic or alkaline service without overcoating. The inorganic coatings have outstanding ability to withstand exposure to solvents, oils and most petroleum products. They are unaffected by aliphatics, aromatics, ketones, or alcohols. They resist dry chlorinated hydrocarbons, but are attacked by wet chlorinated solvents which release hydrochloric acid. They are very resistant to high humidity, splash and spray, but should be topcoated for prolonged continuous salt water exposure. Recommended top temperatures are 140°F wet or 700°F dry, although certain topcoats can raise

the latter limit to 1000°F. Abrasive resistance on structural steel plate has been shown to be excellent in SSPC tests. Weathering of the inorganic coatings is considered outstanding as the coatings continue to cure during prolonged exposure.

Compared with the inorganics, the organic coatings are generally more tolerant of variation in surface preparation quality. They tend to have better compatibility with topcoats and to be more flexible, but to be somewhat less tough and abrasion resistant than the inorganic materials. Their top temperature limits and resistance to solvents vary widely, depending on the vehicle used. As might be expected, their properties combine the properties of the vehicle with the abrasion resistance and galvanic action of the zinc.

2.5 The choice of the best coating for a specific end use must be made by a comparison of properties with the requirements of the service. Application and surface preparation problems may limit the choice. Flexibility of coating may be a factor. The degree of corrosion inhibition desired may be a prime consideration. Zinc-rich coatings are characterized by the abrasion resistance, toughness of film and galvanic protection afforded by the zinc. Many formulations exhibit high reactivity initially but develop a layer of zinc corrosion products that retards further zinc sacrifice until damage of the film exposes the substrate. However, the greater the galvanic demand on the zinc, the faster the coating will break down, unless protected by the zinc corrosion products or by the use of topcoats. Unless galvanic protection is the major factor, (in which case other forms of cathodic or anodic protection should be considered) the better coatings from the standpoint of long-term durability must be formulated carefully to match the protection afforded by the zinc to that required by the substrate.

### 3. TENTATIVE REQUIREMENTS

3.1 Coating History: Documented information with authenticated data detailing the past history and experience with the coating in terms of service life under specific conditions should be requested prior to purchase. All details relative to surface preparation and application of coating shall be supplied. Sufficient identifiable characteristics other than trade or brand name or designated number or symbol shall be provided to permit laboratory test verification of coating identity. These characteristics shall include formulation information readily derivable in a laboratory, including the general nature of the vehicle, pigment, and volatile portions, the weight per gallon, the percent solids by volume, and other procedures used for quality control during manufacture of the coating.

3.2 Inorganic coatings shall have a minimum zinc content of 75% by weight of the non-volatile portion. The corresponding value for organic coatings shall be 80%.

3.3 The dried coating (7 days drying time) on a blast cleaned steel panel when scratched with the cut end of a common paper clip shall be abraded through to the steel only with considerable difficulty and shall not flake or show other signs of poor adhesion adjacent to the cut. When rubbed with the rounded end of the paper clip, the coating shall be burnished to the characteristic zinc appearance.

3.4 The coating shall be applied and cured according to the manufacturer's recommendation to all surfaces, except as noted, of a 4-inch wide by 6-inch high, white metal blast cleaned hot-rolled steel panel. Before application to the face of the panel, a centrally positioned inverted V-shaped area one-half inch wide at the bottom of the panel and zero width at the top edge shall be masked to prevent application of coating to this area. After curing, the mask shall be removed and, if masking was done by means of tape, any traces of remaining adhesive shall be removed by washing with mineral spirits. When subjected to 96 hours of salt spray in accordance with Method 6061 of Federal Test Method Standard No. 141, with 5% salt solution, at least 10% of the uncoated area shall show red rusting that is no more than moderate in degree and at least 10% of the uncoated area shall be free of rust. In addition, no rusting shall be evident on the coated area.

### 4. SAFETY

Container labels and application instructions shall conform to the suggested wording of the Manufacturing Chemists Association publication, "Guide to Precautionary Labelling of Hazardous Chemicals."

### 5. INSPECTION

All work and materials supplied under this specification shall be subject to inspection by the buyer or his representative.

The coating shall be tested to the extent agreed upon by the buyer and seller for conformance to the requirements of Section 3.

### APPENDIX

A.1 In choice of product, the buyer is cautioned to consider the specific history, application characteristics, mil-square feet coverage, intended end use, and the assistance furnished by the supplier rather than price alone.

A.2 Pending adoption of a zinc-rich specification, the SSPC will welcome comments on the use of this "in preparation" version.

A.3 Available Specifications: A limited number of public specifications are presently available. MIL-P-23236, for fuel and ballast tanks, is a performance specification requiring a lengthy succession of laboratory tests for qualification, followed by an 18 month field

test. It is not limited to zinc-rich paints but also covers other classes of paint systems representing urethanes, epoxies and coal tar epoxies. The acceptable zinc-rich types are limited to inorganics and test conditions are confined to immersion. Both self-cured and post cured products are on the qualified product list.

Another Government specification, MIL-P-26915A, is written in such a way that materials having a relatively low zinc content (70 to 80% of total solids) will qualify; the lower values are usually insufficient for true sacrificial protection. This specification provides for several types of accelerated weathering and for an electrical resistance measurement. It does not require any particular vehicle, either organic or inorganic as long as it is "suitable for the intended purpose." Although the MIL-P-26915 specification requires the Type II (high purity), grade zinc dust, the less expensive Type I (standard) grade zinc dust formulas are suggested for all applications except on interiors of potable (drinking) water containers.

The third Government specification, MIL-P-21035, also specifies no particular vehicle, but does require a higher minimum zinc content (94% pigment x 97.5% zinc). It also requires a salt spray durability test. The Type I, regular quality zinc dust is specified, but it is recommended that the Type II (high purity), grade zinc dust be used for potable (drinking) water containers.

Other current zinc-rich specifications include MIL-P-46105, "Weld Through Zinc Rich" 25 March 1966

(U.S. Army Materiel Command), and Canadian Specifications 1-GP-171, "Coatings, Inorganic Zinc" and 1-GP-181, "Coating Zinc-Rich, Organic Ready-Mix."

TT-P-001046 (GSA-FSS) covers specifically a chlorinated rubber one-package ready mix zinc-rich with more than 88% zinc content by weight in the dry film. It is for renewal of galvanize, and primer over steel and galvanize.

MIL-P-38336 (USAF) covers self-curing inorganic zinc-riches, of types thinnable with water, alcohol, or ethylene glycol monoethyl ether (cellosolve).

California Highway Department Specification 66-G-55 is limited to 1) a lithium silicate and 2) an ethyl silicate, together with their control and use.

A.4 Paint prepared in accordance with this specification does not necessarily comply with Section K, Rule 66, Los Angeles County Air Pollution Control District or other air pollution control requirements.

If the formulation of a paint product is changed, in the solvent portion only with no change in the rest of the formulation, and the manufacturer can certify that when tested according to ASTM-D-822-60 (Accelerated Weathering) and for tensile strength and elongation by an Instron or similar tester, the original formulation and the proposed substitute give essentially the same results, he is justified then in certifying, pending the completion of service tests, that the substitution of one solvent for another has made no change in the service life of the material."

Galvanizing Repair Paint

SECTION J

Manufacturers' Specifications

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TRANSMITTAL LETTER

Protective Coatings  
Division

September 12, 1979

Mr. Fred Ordway  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

4 OCT 1979

Dear Mr. Ordway:

We are pleased to enclose the following:

Inorganic Zinc Specification References

Product Bulletins for Ameron Protective  
Coatings Inorganic Zinc Coatings as follows:

Dimetcote E-Z	Dimetcote 5
Dimetcote E-Z II	Dimetcote 6
Dimetcote Steel Primer 1	Dimetcote 8
Dimetcote Steel Primer 2	Dimetcote 9
Dimetcote 3	Dimetcote 9FT
Dimetcote 4	Dimetcote 10
Dimetcote 4 Food Grade	

Please feel free to call on us if you have further questions  
of any kind.

Very truly yours,

Harlan H. Kline  
Manager, Field Service

HLK:rs  
Enclosure

# Dimetcote E-Z

Patent No. 3,653,930

Inorganic zinc coating

Single package simplifies storage and mixing of separate components, eliminates waste of mixed but unused product, and reduces application labor costs

Meets nuclear power plant requirements

Available in environmental colors

Can be used on faying surfaces

Proven by nearly 10 years of field use

## Typical Uses

Structural steel and piping, tank exteriors, bridges, offshore platforms, marine hulls, abutments, waterways, and ship superstructures and decks

## Outstanding Characteristics

Available in color, Dimetcote E-Z resists extreme weathering and atmospheric pollutants. A single package with a recommended topcoat, Dimetcote E-Z is resistant to industrial chemical exposure, as well as marine exposure, including the salt water environment.

## Resistance Guide

Dimetcote E-Z without a topcoat has excellent resistance to weathering and ultraviolet exposure, water and neutral salt, refined petroleum products, acids, and alkalis, and to mold and vegetation.

With a topcoat, Dimetcote E-Z has excellent resistance to acid and alkali, most organic solvents, and most types of industrial marine exposure.

## Topcoats over Dimetcote E-Z

Dimetcote E-Z may be painted with a variety of topcoats. For a complete list of topcoats, contact your Ameron representative.

An epoxy, 383 HS polyamide epoxy, or Amercoat 99 high-build epoxy. Get specific recommendations from your Ameron representative.

Dimetcote E-Z is not recommended for use where exposure to acid or alkali might occur, nor is immersion in these solutions recommended. Get specific recommendations from your Ameron representative.

An "E" version is available to comply with South Coast Air Quality Management District Rule 442 (formerly Rule 661) and equivalent regulations applicable to surface applied coatings and solvents.

## Application Data Summary

**Surface preparation** Dry abrasive blast

**Equipment** Standard industrial spray equipment

For complete information on procedures, equipment, and safety precautions, see detailed application instructions. Like all high performance coatings, Dimetcote E-Z must be applied as recommended to obtain maximum performance.

**Safety** Improper use or handling of Dimetcote E-Z can be hazardous to health and cause fire or explosion. Safety precautions included with the application instructions must be observed during storage, handling, and use.

## Physical Data

**Finish** ..... Flat  
**Color** ..... See color card  
**Surface** ..... Steel, abrasive-blasted  
**Components** ..... 1  
**Cure** ..... Solvent release and reaction with atmospheric moisture

✓ **Volume solids** ..... 50%  
(void content method)

**Dry film thickness** ..... 2½ mils (65 µ) per coat

**Coats** ..... 1

**Calculated coverage at**  
**1 mil (25 µ)** ..... 800 sq ft/gal  
(19.7 sq m/ltr)  
**2½ mils (65 µ)** ..... 320 sq ft/gal  
(7.9 sq m/ltr)

**Allow for application losses and surface irregularities.**

**Application** ..... Conventional spray

**Drying time**

**Dry to touch** ..... 15-20 min @ 77 F  
(25 C) and  
50-90% R.H.  
(ASTM D 1640)

**Dry-through** ..... 20-30 min @ 77 F  
(25 C) and  
50-90% R.H.  
(ASTM D 1640)

**Water-insoluble** ..... 15 min above 77 F  
(25 C) and  
50-90% R.H.

**To topcoat** ..... 16 hrs @ 77 F (25 C)  
and 50-90% R.H.

**Drying and curing times are influenced by temperature and humidity.**

**Temperature limit** ..... Up to 750 F (400 C) dry

✓ **Percent zinc in dry film** .. 82.2% by weight

**Flash point** ..... 77 F (25 C)  
(ASTM D 1310) Tag Open Cup  
"E" version ..... 50 F (10 C)  
Tag Open Cup

**Thinner**

**Amercoat 65** ..... Surface temps.  
below 70 F (21 C)  
**Amercoat 101** ..... Surface temps.  
above 70 F (21 C)

**Cleaner** ..... Amercoat 12  
Use "E" version thinner and cleaner in air pollution control areas.

**Packaging and**

**shipping weight**  
**1-gal unit** ..... Approx. 18 lbs  
(8.2 kg)

**5-gal unit** ..... Approx. 90 lbs  
(40.8 kg)

**Shelf life** ..... 1 yr from  
shipment date

## Dimetecote "E-Z"

### Warranty

Ameron's products are warranted to be free of defects in material or workmanship. If a product does not conform with this Warranty, Buyer must notify Ameron within five days of discovery of the defect, but in no event later than one year after delivery date, or after expiration of the applicable shelf life, whichever is shorter. Ameron's sole obligation under this Warranty shall be at its option, to credit Buyer's account, or to supply replacement material or repair. Failure to notify Ameron of nonconforming goods under this Warranty, within the time specified above, shall bar Buyer from recovery hereunder.

It is expressly understood that Ameron makes no other warranties concerning

the goods, and the sole remedy of the Buyer and the sole liability of Ameron for product defect shall be as set forth above. No other warranties, express or implied, whether of merchantability or of fitness for any particular use shall apply. Ameron shall not be responsible for consequential damages.

Any recommendation or suggestion relating to the use of the products made by Ameron either in technical literature or in response to specific inquiry is given in good faith, but it is for Buyer to satisfy itself of the suitability of the goods for its own particular purpose and it will be deemed to have done so.

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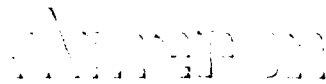
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Protective Coatings  
Division

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R4.79 supersedes R4.74  
Printed in U.S.A.

# Dimetcote E-Z II

Inorganic-zinc coating



Dimetcote E-Z II represents a new generation of Ameron's time-tested, single-package Dimetcote E-Z, providing improved storage and application properties

Improved zinc suspension — easily mixed to uniform consistency after shipment and storage

May be applied over blasted or pickled surfaces

Can be applied by airless or conventional spray to form a smooth film with negligible overspray even in hot weather

Excellent tolerance to heavy film build in corners and angles

Can be applied at temperatures as low as 32°F (0°C)

Outstanding application characteristics over a wide range of atmospheric conditions

Available in environmental colors

## Outstanding Characteristics

Dimetcote E-Z II combines resistance to severe weathering and corrosive environments with all the advantages of single packaging: plus superior application ease and versatility. The single package simplifies storage and mixing of separate components, eliminates waste of mixed but unused product, and reduces application labor costs. When applied with airless or conventional equipment, Dimetcote E-Z II shows exceptional tolerance to film thickness variations occurring on structural shapes. Its film thickness tolerance of 12 mils without cracking is greater than that of any solvent-based, single-package or two-package inorganic zinc.

Dimetcote E-Z II is suitable, among other applications, for use on structural steel and piping, tank exteriors, bridges, offshore platforms, marine hulls above the waterline, and ship superstructures and decks.

## Resistance Guide

Dimetcote E-Z II without a topcoat has excellent resistance to weathering and ultraviolet

exposure, splash and spill of refined petroleum products, neutral organic solvents, alcohols, fats, and oils.

With suitable topcoats, Dimetcote E-Z II is recommended for atmospheric, nonimmersion service in corrosive chemical plant exposures and in marine and offshore exposures. Suitably topcoated, Dimetcote E-Z II withstands fumes and splash of mild alkalis, salt solutions of most types, and mild acid fumes; these coating systems are not recommended for tank lining or other immersion services.

Dimetcote E-Z II without a topcoat is not recommended as a tank lining or where splash or spillage of acid or alkali might occur.

## Topcoats over Dimetcote E-Z II

Dimetcote E-Z II may be coated with epoxies, vinyls, acrylics, chlorinated rubbers, urethanes, or other topcoats. Typical Ameron topcoats are Amercoat 383HS polyamide epoxy or Amercoat 99 high-build vinyl. Get specific recommendations from your Ameron representative.

## Physical Data

Finish .....	Flat
Color .....	Green
Surface .....	Steel
Components .....	1
Cure .....	Solvent release and reaction with atmospheric moisture
Volume solids .....	58% (ASTM D 2697)
Dry film thickness .....	2½ mils (65µ) per coat
Coats .....	1
Application .....	Airless or conventional spray
Drying time	
Dry to touch (ASTM D 1640) .....	5 min @ 77°F (25°C) and 50-90% R.H.
Dry through (ASTM D 1640) .....	15 min @ 77°F (25°C) and 50-90% R.H.
To topcoat .....	16 hrs @ 77°F (25°C) and 50-90% R.H.
Water insoluble .....	15 min above 77°F (25°C) and 50-90% R.H.
Drying and curing times are influenced by temperature and humidity.	
Calculate coverage at	
1 mil (25µ) .....	930 sq ft gal (23 sq m ltr)
2½ mils (65µ) .....	370 sq ft gal (9.1 sq m ltr)
Allow for application losses and surface irregularities.	
Temperature resistance 750°F (400°C) dry	
Percent zinc in dry film .....	76% by weight
Flash point	
Setaflash	
Closed Tester (ASTM D 3278) .....	80°F (27°C)
Thinner	
Amercoat 65 .....	Surface temps below 70°F (21°C)
Amercoat 101 .....	Surface temps above 70°F (21°C)
Cleaner .....	Amercoat 12
Packaging and shipping weight	
1 gal .....	Approx. 18 lbs (8.2 kg)
5 gal .....	Approx. 90 lbs (40.8 kg)
Shelf life .....	6 months from shipment date

Note: To conform to local air pollution control regulations, Dimetcote E-Z II may not be applied to exterior surfaces with exhaust fumes.

# Dimetecote™ E-Z II

## Application Data Summary

For complete information on procedures, equipment, and safety precautions, see Ameron's detailed application instructions. Like all high performance coatings, Dimetecote E-Z II must be applied as recommended to obtain the maximum protection possible.

**Surface preparation** — Dry, abrasive blasting or pickling.

**Equipment** — Standard industrial spray equipment, either conventional or airless.

**Safety** — Improper use or handling of Dimetecote E-Z II can be hazardous to health and cause fire or explosion.

Safety precautions included with the application instructions must be observed during storage, handling, and use.

## Warranty

Ameron's products are warranted to be free of defects in material or workmanship. If a product does not conform with this Warranty, Buyer must notify Ameron within five days of discovery of the defect, but in no event later than one year after delivery date, or after expiration of the applicable shelf life, whichever is shorter.

Ameron's sole obligation under this Warranty shall be at its option, to credit Buyer's account, or to supply replacement material or repair. Failure to notify Ameron of nonconforming goods under this Warranty, within the time specified above, shall bar Buyer from recovery hereunder.

It is expressly understood that Ameron makes no other warranties concerning the goods, and the sole remedy of the

Buyer and the sole liability of Ameron for product defect shall be as set forth above. No other warranties, express or implied, whether of merchantability or of fitness for any particular use shall apply. Ameron shall not be responsible for consequential damages.

Any recommendation or suggestion relating to the use of the products made by Ameron either in technical literature or in response to specific inquiry is given in good faith, but it is for Buyer to satisfy itself of the suitability of the goods for its own particular purpose and it will be deemed to have done so.

## Drying and Curing Times at 2½ mils (65 microns)

	Surface Temperature	Relative Humidity	Time
To touch*	65-80 F (18-27 C)	50-90%	5-10 minutes
	45-65 F (10-18 C)	50-90%	10-12 minutes
Dry through*	65-80 F (18-27 C)	50-90%	12-15 minutes
	45-65 F (10-18 C)	50-90%	15-25 minutes
Water insoluble	45 F or higher	50-90%	15 minutes
To topcoat	65-80 F (18-27 C)	50-90%	16 hours
	32-50 F (0-10 C)	50-90%	24-48 hours

\*As defined in ASTM D 1640

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**Ameron**

# **DIMETCOTE<sup>®</sup>**

## **STEEL PRIMER 1M**

PROTECTIVE COATING

☐ **INDUSTRY'S FIRST SINGLE-PACKAGE  
INORGANIC ZINC**

☐ **NO COMBINING OR MEASURING OF  
COMPONENTS, NO POT-LIFE LIMIT OR  
WASTAGE: NO STRAINING REQUIRED**

☐ **APPLIES BY AIRLESS OR CONVENTIONAL  
SPRAY — IN AUTOMATIC OR MANUAL  
SPRAY EQUIPMENT**

☐ **STIRS LIKE PAINT TO A UNIFORM  
CONSISTENCY**

■  $\frac{3}{4}$  mil (20  $\mu$ ) film protects steel for over one year  
even in tropical atmospheres

■ Durable; less touch up and reparation due to  
mechanical abuse

■ Readily cut or welded by automatic or manual  
methods; minimum burnback from edge of cut  
or weld

■ No adhesion of weld spatter

■ No special ventilation needed

■ No lead added

### **PRINCIPAL USES:**

As a shop primer, protects against water, weathering  
and abrasion on:

- Steel Shapes and Plates ■ Interior and Ex-  
terior Steel Surfaces Before and During Con-  
struction ■ Ships, Barges, Tank Exteriors and  
Other Marine and Industrial Structures

### **SYSTEMS USING DIMETCOTE STEEL PRIMER 1M**

A single coat at  $\frac{3}{4}$  mil (20  $\mu$ ) dry film thickness  
topcoated after fabrication with suitable inorganic  
zinc, vinyl, epoxy, coal tar epoxy or chlorinated rub-  
ber topcoats. Obtain specific recommendation from  
Ameron.

**REPAIR** This primer may be used to repair itself.

**NOTE:** To conform to local air pollution control regula-  
tions, Dimetcote Steel Primer 1M is available in an "E"  
exempt version with exempt thinners and cleaners.

**TYPE:** Single-Package  
Inorganic

**USE:** Zinc Shop Primer  
Preconstruction Primer

**SUITABLE  
FOR:** Steel

FINISH.....	Matte
COLOR.....	Zinc Gray
RECOMMENDED DRY FILM THICKNESS PER COAT.....	$\frac{3}{4}$ Mil (20 mu)
NO. OF COATS REQUIRED.....	1
✓ TOTAL VOLUME SOLIDS.....	26.6% <sup>(1)</sup> 35% <sup>(2)</sup>
THEORETICAL COVERAGE* @ 1 MIL (25mu).....	560 Sq. Ft. per Gal. <sup>(2)</sup> (13.7 m <sup>2</sup> /ltr)
THEORETICAL COVERAGE* PER COAT @ $\frac{3}{4}$ MIL (20 mu).....	740 Sq. Ft. per Gal. <sup>(2)</sup> (18.1 m <sup>2</sup> /ltr)
*See Ameron Technical Report of Coverage of Inorganic Zincs. When computing working coverages, allow for appli- cation losses, surface irregularities, etc.	
NO. OF COMPONENTS.....	1
APPLY OVER.....	Abrasive-blasted Steel
APPLY BY.....	Airless or Conven- tional Spray
DRYING TIME @ 70°F (21°C) Mechanical Handling.....	Approx. 5-10 min.
To Topcoat.....	24 hrs.
COMPATIBLE TOPCOATS.....	Inorganic Zincs, Vinyls, Epoxies, Coal Tar Epoxies, Chlor- inated Rubbers
THINNER.....	Amercoat 65
Order 1 gal. per 16 gals. DSP-1M	
CLEANER.....	Amercoat 12
Order 1 gal. per 10 gals. DSP-1M	

TEMPERATURE RESISTANCE.....	600°F (315°C) dry
FLASH POINTS (Tag Open Cup):	
DSP-1M.....	70°F (21°C)
DSP-1M"E".....	64°F (18°C)
COMBUSTIBILITY.....	Dry film non- combustible
ELECTRICAL CONDUCTIVITY	Weak conductor

PACKAGING and	5 gal.
SHIPPING WEIGHT.....	78.5 lbs. (35.6 kg)
GUARANTEED SHELF LIFE	1 year
From shipment date when stored indoors @ 40-100°F (5-38°C)	

U.S. Patent #3653930

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(1)Volatiles Measurement Method  
(2)Void Content Measurement Method

# DIMETCOTE® STEEL PRIMER 1M

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

- ☐ Before applying Dimetcote Steel Primer 1M to new steel — **Dry-abrasive blast**, including all pits and depressions, remove all mill scale, grease, paint or foreign matter. Surface profiles from abrasive blasting should be similar to that obtained with fresh steel grit (G-40 size), steel shot (S-230 size), graded flint or silica sand (30-60 mesh) under minimum nozzle pressure of 100 psi (7 kg/cm<sup>2</sup>). If reusing blasting abrasives, clean them of contamination before reusing; do not reuse sand or flint abrasives. Where an automatic blasting unit is used, its manufacturer should be consulted for "working" abrasive mixtures and line speeds.
- For Immersion Service:** White metal blast per SSPC-SP-5-63. **For Non-immersion Service:** Commercial blast per SSPC-SP-6-63. Remove dust and or sand. Apply coating before any rust bloom forms.
- ☐ Before topcoating Dimetcote Steel Primer 1M — **Clean surface thoroughly**, removing dirt, grease oil or other organic contaminants by any convenient method such as steam cleaning, detergent cleaning, washing or brush blasting. Removal of existing DSP-1M is not required except in some cases where the steel will be used in tank lining service. DSP-1M is recommended for use with Dimetcote inorganic zinc tank linings and need not be removed before application of Dimetcote. Obtain specific recommendation from Ameron for use of DSP-1M with organic tank lining coatings.
- ☐ Preparing welded or damaged Dimetcote Steel Primer 1M — Prepare welds or damaged areas for topcoating by local "pencil" or vacuum blasting or needle gun cleaning. When a full coat of Dimetcote is used over DSP-1M, no further repriming is necessary. Where organic topcoats are used directly over DSP-1M, these areas should be primed with a Dimetcote product or other inhibitive primer. Ask Ameron for a specific recommendation.

### EQUIPMENT REQUIRED

- ☐ For Airless Spray
  - Standard airless spray equipment, such as:

	Graco	Spee-Flo
Gun	Hydramastic 206-718 or 205-591 or Recirculating 206-717 Remove filter from gun	Model H
Tip	.026" (.7mm) or larger	.026" (.7mm) or larger
Pre-Orifice	Not applicable	.039" (1.0mm)
Pump	Bulldog	PZ 914
Pump Ratio	10, 28, or 30:1	14:1
Packing	Teflon	Leather

- Revers-A-Clean tips recommended.
- Air intake 15-25 psi (1.0-1.8 kg/cm<sup>2</sup>).
- 30 mesh filter on material pick-up line.
- Air agitator with very slow speed.
- Fluid hose to gun, 3/8" (1.0cm) I.D.

### SAFETY EQUIPMENT REQUIRED

(In Tanks or Confined Spaces only)

- Explosion-proof lights and electrical equipment.
- Fresh air mask, such as DeVilbiss P-MPH 527 and MPH 529, connected by 1/4" (.64 cm) I.D. hose directly to air source.
- Nonsparking shoes and tools for workers in area.
- Exhaust fan of sufficient capacity to keep solvent vapors below 20% of the explosive limit of 1/4% by volume of solvent vapor in air. Refer to Ameron Safety Precautions included with shipment for required blower sizes.

- ☐ For Conventional Spray
  - Industrial gun, such as:

	DeVilbiss	Binks
Gun	MBC	18
Air Cap	2 or 704	63PB
Fluid Tip	FF or 2FF	63B

- Pressure pot with mechanical agitator
- Separate atomizing air and fluid pressure regulators
- Air supply: compressor capable of continuous volume of 20 CFM (10 ltr/sec) of at least 50 psi (3.5 kg/cm<sup>2</sup>) to each gun nozzle.
- Moisture trap, to insure moisture-free air supply, such as DeVilbiss HRE-501 Oil and Moisture Separator, must be in the line between compressor and pressure spray pot and spray gun.
- Air hose for gun, 5 1/8" (.8cm) I.D.
- Material hose, 1 1/2" (1.25cm) I.D.

### APPLICATION PROCEDURE

**CAUTION:** Moisture and water contamination will cause skinning and gelling of Dimetcote Steel Primer 1M. Keep container closed at all times. During spraying application, moisture trap must be employed.

1. **Flush all equipment with Amercoat 12 Cleaner** to clean and remove moisture.
2. **Power stir material thoroughly until uniform.** Continue to agitate slowly during application to maintain uniform suspension. Keep system closed to prohibit air or moisture from entering.
3. **Thinning is not normally required**, but if needed for workability or if in hot windy weather, thin with no more than 1 pint (1/2 liter) Amercoat 65 Thinner per gallon DSP-1M.
4. **Apply in even, parallel passes that overlap 50%.**  
NOTE: If using conventional spray, regulate air pressures to 10-15 psi (0.7-1.0 kg/cm<sup>2</sup>) on pot, 25-50 psi (1.8-3.5 kg/cm<sup>2</sup>) on gun; when using airless adjust in-bound pressure at pump to 15-25 psi (1.0-1.8 kg/cm<sup>2</sup>).
5. **When dry to touch**, check film thickness with nondestructive dry film thickness gauge. If film is less than 3 1/2 mil (20 µ), apply additional material.
6. **If necessary to recoat**, wait until first coat is dry to touch.
7. **Allow to dry approximately 10 minutes @ 32°F (0°C)** or above before handling. May be handled by electromagnets or cable slings.
8. **To resist water damage**, film should dry at least 15 minutes above 32°F (0°C).
9. **Before topcoating**, allow to dry 16 hours @ 70°F (21°C), 50% RH.

NOTE: If humidity is extremely low, spray a water mist to speed curing.

10. **Clean all equipment with No. 12 Cleaner** as needed.
11. **Store unused material** in tightly closed, watertight container to prevent skinning or gelling.

Skinned material can be used by remixing and straining. Gelled material must be discarded.

**WARNING:** This product is flammable and causes skin and eye irritation. Keep away from heat and open flame. Keep container closed. Use with adequate ventilation. Avoid prolonged breathing of vapor. Avoid contact with skin or eyes. Do not take internally. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention. If used in confined areas, observe the following precautions to prevent hazards of fire or explosion or damage to the health: (1) circulate adequate fresh air continuously during application and drying; (2) use fresh air masks and explosion proof equipment; (3) prohibit all flames, sparks, welding and smoking.

If welding is to be performed in confined spaces on steel coated with Dimetcote Steel Primer 1M, do so in accordance with instructions in American National Standard Z 49.1-1967, "Safety in Welding and Cutting."

Flash Points (Tag open cup): Dimetcote Steel Primer 1M 70°F (21°C) Dimetcote Steel Primer 1M "E" 50°F (10°C)

NOTE OUR NEW  
DIVISION NAME!

# AMERCOAT® DIMETCOTE STEEL PRIMER 2

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

#### ☐ Immersion Services —

- As a weldable preconstruction primer or as a shop or field-applied primer, dry-abrasive blast, including all pits and depressions, remove all mill scale, rust, rust scale, grease, paint or foreign matter. Surface profiles from abrasive blasting should be similar to those obtained with fresh steel grit (G-40 size), steel shot (S-230 size), graded flint or silica sand (30-60 mesh). Use nozzle pressure of 100 psi with air volume at 200 CFM minimum. If reusing blasting abrasives, clean them of contamination before reusing; do not reuse sand or flint abrasives.

Where an automatic blasting unit is used, its manufacturer should be consulted for "working" abrasive mixtures and line speeds.

#### ☐ Nonimmersion Services —

- As a weldable preconstruction primer or shop or field-applied primer, dry-abrasive blast new steel in accordance with Steel Structures Painting Council Specification SP-6-63 for "Commercial Blast."
- As a field-applied primer for old steel, dry-abrasive blast in accordance with Steel Structures Painting Council Specification SP-10-63T for "Near White Metal."

### EQUIPMENT REQUIRED

- Pressure material pot with mechanical agitator.
- Separate atomizing air and fluid pressure regulators.
- Air supply: continuous volume of 20 CFM at 35-50 psi minimum to each gun nozzle (with DeVilbiss equipment).
- Air hose for gun, 5/16" ID.
- Material hose, 1/2" ID.
- Industrial spray gun, such as DeVilbiss MBC 704FF or 24FF with leather or Teflon needle packing and heavy mastic spring.
- 30-60 mesh metal screen.

### SAFETY EQUIPMENT REQUIRED

(In Tanks or Confined Areas Only)

- Air mask, such as DeVilbiss P-MPH 527 and MPH 529, connected by 1/4" ID hose directly to air source.

**WARRANTY:** Refer to Ameron's Terms and Conditions of Sale for warranty on this product

### APPLICATION PROCEDURE

1. Clean all equipment with fresh water.
2. Discard desiccant bag from powder can.
3. Thoroughly mix total contents of each powder can slowly into total contents of each liquid can until well dispersed. Use power mixer. Do not reverse order. Do not vary proportions.
4. Do not thin for any reason.
5. Strain mixture through 30-60 mesh screen to remove large particles.
6. Remove all dust from surfaces to be coated.
7. Regulate air pressure: 30-50 psi to gun (with DeVilbiss) and 10-15 psi to pot. Note: pressure requirements may vary with temperature and hose length.
8. Keep pressure pot at approximately same elevation as spray gun.
9. Hold spray gun at right angle to work, and make even, parallel passes. Overlap each pass 50%; do not leave bare spots, pinholes, or holidays.
10. Apply a heavy, wet coat. Double-lap spray all welds, corners, edges, etc.
11. Clean all equipment immediately after use with fresh water.
12. Allow Dimetecote Steel Primer 2 to dry at least 15-30 minutes: 50-95°F, 50-95% humidity to resist intermittent contact with water, rain or condensation.
13. Before handling Dimetecote Steel Primer 2, allow to dry 15 minutes or less on warm (above 50°F) steel.
14. If additional thickness is desired, recoat when 1st coat is dry to touch.
15. Before topcoating, allow to dry 24 hours at 75°F.

### TO TOPCOAT DIMETCOTE STEEL PRIMER 2

1. When used as a field primer, topcoat with vinyl or epoxy. For epoxy, apply full coat at recommended coverage for epoxy topcoat. For vinyls, see note below.
2. When used as an after-blast primer to be topcoated with an inorganic zinc: (a) roughen and clean surface with dry brush-off blast. Tightly-adhering Dimetecote Steel Primer may remain. (b) apply inorganic zinc topcoat according to that product's application instructions.
3. When used as an after-blast primer to be topcoated with epoxy or vinyl: (a) dry surface and remove oil, grease, or other contaminants with Amercoat No. 57 Oil Cleaner. (b) apply epoxy full coat at recommended coverage. For vinyls, see note below.

**NOTE:** If topcoating with vinyls, apply tie-coat where required, then topcoat. For best results with high-build topcoats, apply light "mist" of topcoat material to avoid solvent bubbling. When mist coat is tack-free (a few minutes), apply full topcoat.

**WARNING:** Dimetecote Steel Primer 2 Powder is a harmful dust. Avoid breathing dust. Wash thoroughly before eating or smoking. Keep away from feed or food products.

**WARNING:** Dimetecote Steel Primer 2 Liquid may cause burns to skin and eyes. Avoid contact with skin, eyes, and clothing. Do not take internally. When handling, wear goggles or face shield. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

**WARNING:** Do not leave mixed material in sealed container beyond the expected pot life as gassing may cause container to burst.

If welding is to be performed in confined spaces on steel coated with Dimetecote Steel Primer 2, do so in accordance with instructions in U.S.A. Standard Z 49.1-1967, "Safety in Welding and Cutting."

**Ameron**

Protective Coatings  
Division

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- THE ORIGINAL 100% INORGANIC ZINC SILICATE COATING; PROVED SUPERIOR BY OVER 25 YEARS ON THE JOB!
- UNEQUALED TANK LINING SERVICE HISTORY
- A TRULY "PERMANENT" PRIMER FOR STEEL
- ONE COAT PROVIDES MAXIMUM PROTECTION
- UNAFFECTED BY EXTREME COLD OR HIGH TEMPERATURES

• Bonds chemically to steel • Self-inspecting — immediately shows improper surface preparation or application by not adhering... eliminates failure at critical times • Highly abrasion resistant • Protects cathodically like galvanizing, and with salt water resistance • Extremely good temperature resistance • Follows normal expansion and contraction of steel • Since it is post-cured, it is extremely reliable under a topcoat and increases topcoat life 2 to 10 times.

Conforms to: Qualified Products List for MIL P-23236 (Ships), Type 1, Class 3 — "Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast." Also meets government requirements for coating of hulls, decks, and super-structures of Navy and Coast Guard vessels (U.S. Navy Painting Manual Chapter 9190).

Qualified to COMSCINST 9190.40 Military Sea Lift Command for service as tank lining

#### PRINCIPAL USES:

##### 1. Maintenance

- Moderate chemical fume environments, severe marine exposures, petroleum products, abrasion, fresh and salt water.

- Piping Exteriors • Transmission Towers • Offshore Platforms
- Bridges • Ship Decks and Superstructures • Tank Exteriors
- Vapor Spaces • Almost Any Steel Structures Exposed to Severe Weathering and Salt Spray

Apply a single coat of Dimetecote 3 at 3 mils dry film thickness. Badly-pitted surfaces may require 3 to 5 mils dry. Dimetecote 3 may be topcoated with recommended topcoat or topcoat systems for certain services, for appearance, or for visibility.

- Severe chemical exposures, intermittent or continuous immersion.

- Structural Steel • Tank Exteriors • Ship Hulls • Ship Bottoms

Apply a single coat of Dimetecote 3 at 3 mils dry film thickness. Badly-pitted surfaces may require 3 to 5 mils dry. Topcoat with recommended topcoat or topcoat systems.

##### 2. Tank Lining

- Continuous or intermittent services

- Storage and Process Tanks • Ship Cargo Tanks • Fuel Tanks
- Ballast Tanks • So vent Tanks

Apply a single coat of Dimetecote 3 at 3 mils dry film thickness. Badly-pitted surfaces may require 3 to 5 mils dry. No more than 5 mils dry when used as a tank lining.

**NOTE:** When using some topcoats over Dimetecote 3, a tie coat may be required. Obtain a specific recommendation from Ameron.

#### RESISTANCE — When Used Without A Topcoat

This chart is only a guide; for a more comprehensive listing, see the Amercoat Coatings Tank Lining Chart. For specific recommendation, contact Ameron.

**WEATHER:** Unsurpassed resistance. After 25 years in the field, no loss of protective qualities.

**ALCOHOLS:** Insoluble in splash, spillage, fumes, or continuous immersion in alcohols, such as:

Methyl                  Propyl  
Ethyl                     Butyl

**SOLVENTS:** Insoluble in fumes, splash, spillage, or continuous immersion in ketones, esters, chlorinated hydrocarbons, and aromatic solvents such as:

Toluol                  Benzol                  Xylol

**ANIMAL AND VEGETABLE OILS:** Resistant to animal and vegetable oils of less than 2 1/2% acid content.

**NOTE:** Also true with all inorganic zinc silicate coatings. Dimetecote 3 is not recommended for immersion in, or spillage of acid or alkali solutions.

**TEMPERATURE:** Resists continuous temperatures from 100°F up to 600°F (dry); up to 1000°F (dry) intermittently. Cargoes can be carried at their normal temperatures (see Amercoat Coatings Tank Lining Chart.)

**PETROLEUM PRODUCTS:** Completely insoluble in splash, spillage, fumes, or continuous immersion in:

Petroleum      Lubricants      Aviation  
Hydrocarbons   Motor Fuels   Gasoline  
Oils              Jet Fuels      Crude Oils

**WATER:** Unaffected by high humidity, splash, spillage, spray, or intermittent immersion in fresh or salt water, also resistant to continuous immersion in sea water with suitable topcoat or topcoat system.

**Ameron**

## DIMETCOTE 3

PROTECTIVE COATING

**TYPE:** Post-Cured  
Inorganic Zinc

**USE:** Maintenance  
Tank Lining  
Permanent Primer

**SUITABLE  
FOR:** Steel

<b>FINISH</b>	Matte
<b>COLOR</b>	Gray
<b>RECOMMENDED DRY FILM THICKNESS PER COAT</b>	3 Mils
<b>NO. OF COATS</b>	1
<b>TOTAL DRY FILM THICKNESS DIMETCOTE 3</b>	3 Mils
<b>TOTAL VOLUME SOLIDS†</b>	50%
<b>THEORETICAL COVERAGE* @ 1 MIL</b>	800 sq. ft. per gal.
<b>THEORETICAL COVERAGE* PER COAT @ 3 MILS</b>	267 sq. ft. per gal.
*See Amercoat Technical Report on Coverage of Inorganic Zincs. When computing working coverages, allow for application losses, surface irregularities, etc.	
<b>NO. OF COMPONENTS</b>	2
<b>MIXING RATIO</b>	23 lbs. powder to 3/4 gal. liquid
<b>POT LIFE</b>	8 hrs. @ 70 F
<b>APPLY OVER</b>	Blasted steel
<b>APPLY BY</b>	Conventional spray
<b>DRYING TIME</b>	2-4 hrs. before applying cure
<b>CURING TIME</b>	For Service: 24 hrs. minimum
<b>TOPCOAT REQUIRED</b>	Recommended topcoat or none
<b>THINNER</b>	None
<b>CLEANER</b>	Fresh water
<b>MISCELLANEOUS</b>	Order 1 1/4-1 1/2 gal. D-3 Standard or Non-flammable cure per gal. Dimetecote 3

<b>TEMPERATURE RESISTANCE</b>	—100 F to 600 F dry; intermittent to 1000 F dry
<b>FLASH POINT</b>	D-3 Standard Cure: 8 F, Tag Open Cup
<b>COMBUSTIBILITY</b>	Nonflammable with D-3 Non-flam. Cure
<b>WT. PER MIL/SQ. FT. OF DRY FILM</b>	0.5 oz.
<b>ELECTRICAL CONDUCTIVITY</b>	Weak conductor
<b>PACKAGING</b>	Dimetecote 3 — 1 gal. D-3 Standard Cure — 1 & 5 Gal. D-3 Non-flam. Cure — 5 gal.
<b>SHIPPING WEIGHT</b>	Dimetecote 3: 1's — 24 lbs. powder, 7.7 lbs. liquid Dimetecote 3 Standard Cure: 1's — 9 lbs. 5's — 45 lbs. Dimetecote 3 Nonflammable: 5's — 53 lbs
<b>GUARANTEED SHELF LIFE FROM SHIPMENT DATE</b>	1 year

# DIMETCOTE 3 APPLICATION INSTRUCTIONS

## SURFACE PREPARATION

1. Round off all rough welds and sharp steel edges. Remove weld spatter.
2. Dry-abrasive blast, including all pits and depressions; remove all mill scale, rust, rust scale, grease, paint or foreign matter. Surface profile from abrasive blasting should be similar to that obtained with fresh steel grit (G-40 size), steel shot (S-230 size), graded flint or silica sand (30-60 mesh), under nozzle pressure of 100 psi. If reusing blasting abrasives, clean them of contamination before reusing; do not reuse sand or flint abrasives.

Where an automatic blasting unit is used, its manufacturer should be consulted for "working" abrasive mixtures and line speeds.

3. Apply Dimetecote 3 as soon as possible to prevent blasted surfaces from rusting. Keep surfaces moisture-free until coated. Keep oil, grease or other organic matter off surface before coating. Spot reblast to remove any contamination; don't solvent wipe.

## EQUIPMENT REQUIRED

- Pressure material pot with mechanical agitator.
- Separate atomizing air and fluid pressure regulators.
- Air supply: continuous volume at 80 psi minimum to each gun nozzle.
- Air hose for gun, 5 1/2" I.D.
- Material hose, 1/2" I.D.
- Industrial spray gun, such as Eclipse GAT with No. 40 stainless steel fluid tip, No. 17 or No. 27 fan slot nozzle; or DeVilbiss MBC 704E or 64E with leather or Teflon needle packing and heavy mastic spring; or Binks No. 18 with No. 66 fluid nozzle and No. 63PB air nozzle with No. 54-839 mastic spring and No. 54-747 leather or 2-28 Teflon needle packing.
- 30-60 mesh metal screen.

## SAFETY EQUIPMENT REQUIRED

(In Tanks or Confined Areas Only)

- Fresh air mask, such as DeVilbiss P-MPH 527 and MPH 529, connected by 1/2" I.D. hose to air source.
- If D-3 Standard Curing Solution is used, exhaust fan of sufficient capacity to keep solvent vapors below 20% of the explosive limit or 14% by volume of solvent vapor in the air.

Volume of Tank (Gallons)	Required Blower Size* (Cu. Ft. Min.)
500 - 5,000	1,000
5,000 - 20,000	2,000
20,000 - 100,000	5,000
100,000 - 250,000	10,000
250,000 - 500,000	15,000
500,000 - 2,000,000	20,000

\*All blowers to be suction type.

Use ventilation during all applications to reduce dust.

**WARNING: D-3 Standard Curing Solution** is flammable and causes skin and eye irritation. Keep away from heat and open flame. Keep container closed. Use with adequate ventilation. Avoid prolonged breathing of vapor. Avoid contact with skin or eyes. Do not take internally. In case of contact, immediately flush skin with plenty of water, for eyes, flush with plenty of water for at least 15 minutes and get medical attention. In tanks and other confined areas, observe the following precautions to prevent hazards of fire or explosion or damage to the health: (1) circulate adequate fresh air continuously during application and drying; (2) use fresh air masks and explosion-proof equipment; (3) prohibit all flames, sparks, welding and smoking.

**CAUTION: D-3 NonFlammable Curing Solution** causes skin and eye irritation. Avoid contact with skin or eyes. Do not take internally. In case of contact, flush skin with plenty of water; for eyes, flush with plenty of water for 15 minutes and get medical attention.

If welding is to be performed in confined spaces on steel coated with Dimetecote 3, do so in accordance with instructions in U.S.A. Standard Z 49.1-1967, "Safety in Welding and Cutting."

**WARNING:** Do not leave mixed material in closed container beyond the expected pot life as gassing may cause container to burst.

**WARNING: Dimetecote 3 Powder** is a harmful dust. Contains lead. Avoid breathing dust. Wash thoroughly before eating or smoking. Keep away from feed or food products.

## APPLICATION PROCEDURE

1. Flush equipment with fresh water before use.
2. Discard desiccant bag from powder can.
3. Stir total contents of each powder can slowly into total contents of each liquid can until well dispersed. Do not reverse order. Do not vary proportions.
4. Do not thin for any reason.
5. Strain mixture through 30-60 mesh screen.
6. Agitate mixed material throughout application.
7. Remove all dust from surfaces to be coated.
8. Regulate air pressure: 50-75 psi to gun, 10-20 psi to pot with Binks or DeVilbiss; 35 psi to both pot and gun with Eclipse. Note: required pressures may vary with temperature and hose length.
9. Keep pressure pot at same elevation as spray gun.
10. Hold spray gun at right angles to work, and make even, parallel passes. Overlap each pass 50%.
11. Apply a heavy, wet coat to obtain proper thickness with no bare areas, pinholes or holidays.
12. Double-lap spray all welds, corners, edges, etc.
13. Check dried film with dry film thickness gauge. If less than 3 mils, apply extra material up to required thickness before curing. If an extra full coat is desired, apply after 1st coat is cured and curing solution crystals are removed.
14. Clean equipment immediately after use with fresh water. Unused mixed coating material can be chilled and used next day after thorough stirring.
15. Keep moisture off surface until after curing.

## CURING DIMETCOTE 3

### Using D-3 Standard Curing Solution

1. Apply Curing Solution heavily by brush or spray 1 hour or more after Dimetecote 3 has dried (drying normally requires 12 hours where there is good ventilation). Consumption of D-3 Curing Solution should be 1 1/4 to 1 1/2 gallons for each gallon of Dimetecote 3 applied (approximately 1 gallon D-3 Curing Solution for 140 square feet of coated area, allowing for normal application losses). If this amount is not consumed in the first coat of Curing Solution, or if the coating thickness exceeds 4 mils, apply a second coat.

2. Protect surface from moisture for at least 12 hours (or 8 hours if 2 coats curing solution are applied).

3. Curing residue may be washed off after 24 hours. If allowed to remain for a greater length of time, no harm will be done to the coating, but the residue may be more difficult to remove.

### Using D-3 Non-Flammable Curing Solution

1. Apply Curing Solution by brush or spray 1 hour or more after Dimetecote 3 has dried (drying normally requires 12 hours where there is good ventilation).

2. First apply a thin coat and allow to become tacky, then apply a heavy coat. Total consumption of Curing Solution should be 1 1/4 to 1 1/2 gallons for each gallon of Dimetecote 3 applied (approximately 1 gallon D-3 Curing Solution for 140 square feet of coated area, allowing for normal application losses). If necessary, apply another coat of Curing Solution until this quantity has been used. When used in this proportion, a coating thickness up to 5 mils can be adequately cured.

3. If puddles of Curing Solution collect on horizontal surfaces, disperse promptly with air hose, brush, or mop.

4. Protect surface from moisture for at least 8 hours.

5. Curing residue may be washed off after 24 hours. If allowed to remain for a greater length of time, no harm will be done to the coating, but the residue may be more difficult to remove.

**WARNING: Dimetecote 3 Liquid** may cause burns to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally. When handling, wear gloves or face shield. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

**WARRANTY:** Refer to Ameron's Terms and Conditions of Sale for warranty on this product.

**Ameron**

Protective Coatings  
Division  
BREA, CALIFORNIA 92621

- HARDEST 100% INORGANIC ZINC COATING KNOWN — EXCEPTIONAL ABRASION RESISTANCE**
- HIGHEST VOLUME SOLIDS, LOWEST COST PER SQ. FT. OF ANY INORGANIC ZINC COATING**
- EXCELLENT, VERSATILE TANK LINING**
- EASY APPLICATION — ONE COAT PROVIDES MAXIMUM PROTECTION AGAINST CORROSION, WEATHERING, ABRASION**
- WATER-BASED — NO SPECIAL THINNER, CLEANER OR SAFETY PRECAUTIONS NEEDED**

■ Combination of zinc and inorganic silicate — more durable than same thickness of pure zinc ■ Exceptional adhesion to steel with no cracking or peeling ■ Provides cathodic protection at sharp edges, nuts, bolts, rough welds, small abraded areas ■ Easy to apply in wide range of film thicknesses ■ Can be used as shop primer for production-line operations

Conforms to: MIL-P-23236 (Ships), Type 1, Class 3 — "Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast."

#### PRINCIPAL USES

##### □ Maintenance

- Moderate atmospheric or chemical environments, severe marine exposures, petroleum products, abrasion, fresh or salt water.

■ Structural Steel ■ Tank Exteriors ■ Marine Structures ■ Ship Decks and Superstructures ■ Offshore Platforms ■ Transmission Towers ■ Bridges ■ Void Spaces ■ Almost Any Steel Surface Exposed to Severe Weathering or Salt Spray.

Apply a single coat of Dimetecote 4 at 3\* mils dry film thickness. May be topcoated with recommended topcoat or topcoat system for certain services, for appearance, or for visibility.

- Severe atmospheric exposures or mild fume exposures of acids and alkalis.

■ Structural Steel ■ Tank Exteriors ■ Piping

Apply a single coat of Dimetecote 4 at 3\* mils dry film thickness.

**NOTE:** Obtain specific recommendation from Ameron representative for topcoat system.

##### □ Tank Lining

- Continuous or Intermittent Services

■ Storage and Process Tanks ■ Ship Cargo/Ballast Tanks ■ Fuel Tanks ■ Solvent Tanks

A single coat of Dimetecote 4 at 3\* mils dry film thickness. No topcoat.

##### □ Repair

Dimetecote 4 may be used to repair itself or Dimetecote 3.

\*Sharp edges, nuts, bolts, rough welds, or badly-pitted surfaces may require 4 to 6 mils dry film thickness. Up to 8 mils dry film thickness is allowable.

#### RESISTANCE — When Used Without A Topcoat

This chart is only a guide; for a more comprehensive listing, see the Amercoat Coatings Tank Lining Chart. For specific recommendation, contact Ameron.

**WEATHER:** Outstanding resistance. Prolonged exposure under severe conditions does not affect protective capabilities.

**ALCOHOLS:** No effect by continuous immersion in alcohols, such as:

Butyl	Octyl	Methyl
Hexyl	Ethyl	Propyl

**PETROLEUM PRODUCTS:** Completely insoluble in splash, spillage, fumes, or continuous immersion in:

Petroleum Hydrocarbons	Lubricants	Aviation Gasoline
Oil	Jet Fuel	Crude Oils

Also resistant to Chlorinated Hydrocarbons if moisture is not present

**TEMPERATURE:** Resists continuous temperatures up to 600 F (dry); in-

termittent to 800°F (dry). Cargoes can be carried at their normal temperatures (see Amercoat Coatings Tank Lining Chart).

**SOLVENTS:** Insoluble in fumes, splash, spillage, intermittent or continuous immersion in solvents, such as Ketones and Esters.

**ANIMAL AND VEGETABLE OILS:** Resistant to animal and vegetable oils of less than 2½% acid content.

**WATER:** No effect by high humidity or intermittent immersion in either fresh or salt water. Highly recommended for cargo and ballast tank lining subjected to alternating of petroleum products and sea water.

**NOTE:** As is true with all inorganic zinc silicate coatings, Dimetecote 4 is not recommended for immersion in, or spillage of, acid or alkali solutions

## DIMETCOTE 4

PROTECTIVE COATING

**TYPE:** Water-Based, Self-Cured Inorganic Zinc

**USE:** Maintenance  
Tank Lining  
Marine

**SUITABLE FOR:** Steel

<b>FINISH</b>	Matte
<b>COLOR</b>	Blue-Gray
<b>RECOMMENDED DRY FILM THICKNESS PER COAT</b>	3 mils
<b>NO. OF COATS REQUIRED</b>	1
<b>TOTAL DRY FILM THICKNESS DIMETCOTE 4</b>	3 mils
<b>TOTAL VOLUME SOLIDS*</b>	62.2%
<b>THEORETICAL COVERAGE* @ 1 MIL</b>	995 sq. ft. per gal.
<b>THEORETICAL COVERAGE* PER COAT @ 3 MILS</b>	332 sq. ft. per gal.
*See Amercoat Technical Report of Coverage of Inorganic Zincs. When computing working coverages, allow for application losses, surface irregularities, etc.	
<b>NO. OF COMPONENTS</b>	2
<b>MIXING RATIO</b>	25 lbs. powder to 2/3 gal. liquid
<b>POT LIFE</b>	8 hrs. @ 70°F
<b>APPLY OVER</b>	Blasted steel
<b>APPLY BY</b>	Conventional spray
<b>DRYING TIME</b>	Water-insoluble: 30 mins. @ 70°F and above 50% humidity. To Topcoat: Hard; color changed to blue-gray
<b>CURING TIME</b>	Maintenance or Immersion: When hard
<b>TOPCOAT REQUIRED</b>	Recommended topcoat, or none
<b>THINNER</b>	None
<b>CLEANER</b>	Fresh water
<b>TEMPERATURE RESISTANCE</b>	Continuous: 600°F (dry); Intermittent: 800°F (dry)
<b>FLASH POINT</b>	Nonflammable
<b>COMBUSTIBILITY</b>	Noncombustible
<b>WT. PER MIL/SQ. FT. OF DRY FILM</b>	0.5 oz.
<b>ELECTRICAL CONDUCTIVITY</b>	Weak conductor
<b>PACKAGING</b>	1 gallon
<b>SHIPPING WEIGHT</b>	1's—26 lbs. Powder, 7 lbs. Liquid
<b>GUARANTEED SHELF LIFE FROM SHIPMENT DATE</b>	1 year

(Volatiles Measurement Method)

# DIMETCOTE 4 APPLICATION INSTRUCTIONS

## SURFACE PREPARATION

1. **Round off** all rough welds and sharp steel edges. Remove weld spatter.

2. **Dry-abrasive blast**, including all pits and depressions; remove all mill scale, rust, rust scale, grease, paint or foreign matter. Surface profile from abrasive blasting should be similar to that obtained with fresh steel grit (G-40 size), steel shot (S-230 size), graded flint or silica sand (30-60 mesh), under nozzle pressure of 100 psi. If reusing blasting abrasives, clean them of contamination before reusing; do not reuse sand or flint abrasives.

Where an automatic blasting unit is used, its manufacturer should be consulted for "working" abrasive mixtures and line speeds.

3. **Apply Dimetcote 4** as soon as possible to prevent blasted surfaces from rusting. Keep surfaces moisture-free until coated. Keep oil, grease, or other organic matter off surface before coating. **Spot reblast** to remove any contamination; solvent-wiping is not satisfactory.

## EQUIPMENT REQUIRED

- Pressure material pot with low speed agitator.
- Separate atomizing air and fluid pressure regulator.
- Air supply: compressor capable of supplying continuous volume at 80 psi to nozzle of each gun (with Binks or DeVilbiss equipment).
- Air hose for gun, 5 16" I.D.
- Material hose, 1/2" I.D.
- Industrial spray gun, such as Eclipse GAT, with No. 40 stainless steel fluid tip and No. 17 or No. 27 fan slot nozzle, or DeVilbiss MBC 704E or 64E with leather needle packing and heavy mastic spring, or Binks No. 18 with No. 66 fluid nozzle and No. 63PB air nozzle with No. 54839 mastic spring and No. 54747 leather or 2-28 Teflon needle packing.
- 30-60 mesh metal screen.

## SAFETY EQUIPMENT REQUIRED

(In Tanks or Confined Areas Only)

- Fresh air mask, such as DeVilbiss P-MPH 527 or MPH 529, connected by 1/4" I.D. hose directly to air source. Use ventilation during application to reduce dust in work area.

**CAUTION:** Dimetcote 4 Liquid causes skin and eye irritation. Avoid contact with skin or eyes. Do not take internally. In case of contact, flush skin with plenty of water; for eyes, flush with plenty of water for 15 minutes and get medical attention.

If welding is to be performed in confined spaces on steel coated with Dimetcote 4, do so in accordance with instructions in U.S.A. Standard Z 49.1-1957, "Safety in Welding and Cutting."

**WARNING:** Do not leave mixed material in sealed container beyond the expiration date as gasing may cause container to burst.

## APPLICATION PROCEDURE

1. **Keep cans out of sun** prior to mixing. Overheated material may gel.

2. **Flush equipment** with fresh water before use.

3. **Discard desiccant bag** from powder can.

4. **Stir total contents** of each powder can slowly into total contents of each liquid can until well dispersed. **Do not reverse order. Do not vary** these proportions. **Slowly agitate** throughout application.

5. **Do not thin materials** for any reason.

6. **Strain mixture** through 30-60 mesh screen to remove large particles.

7. **Remove all dust** from surface to be coated.

8. **Regulate air pressure:** 50-75 psi to gun, 10-20 psi to pot with Binks or DeVilbiss; 35 psi to both with Eclipse.

**Note:** required pressures may vary with temperature and hose length.

9. **Keep pressure pot** at about same level as gun.

10. **Hold spray gun** at right angle to work, and make even, parallel passes. Overlap each pass 50%.

11. **Apply a heavy, wet coat** to obtain proper thickness with no pinholes, bare areas or holidays.

12. **Double-lap spray** all welds, corners, seams, etc.

13. **Clean all spray equipment** with fresh water immediately after use.

14. **If greater thickness is required**, recoat within 24 hrs. after first coat is dry to touch.

15. **Allow to dry** at least 30 minutes above 70°F and 50% humidity before intermittent contact with water, rain or condensation. **Keep moist air circulating** if in confined area, such as for tank lining. Below 70°F and above 85% humidity, drying time will be prolonged. Below 50°F and above 85% humidity, drying to water-insolubility may take several hours. In areas with high temperatures and very low humidity, or when accelerated curing is desired, wet down with plain water twice a day until material hardens and turns to blue-gray color.

16. **If damaged**, spot reblast or power tool clean. Then add additional Dimetcote 4.

17. **If Topcoating**, allow to cure until surface has changed from brown to blue-gray color and has become hard (metallic).

18. **Before topcoating or using as a tank lining**, wash off surface with water. Remove heavy deposits with a stiff bristle brush. Let surface dry completely.

**WARNING:** Dimetcote 4 Powder is a harmful dust. Contains lead. Avoid breathing dust. Wash thoroughly before eating or smoking. Keep away from feed or food products.

**WARRANTY:** Refer to Ameron's Terms and Conditions of Sale for warranty on this product.

**Ameron**

Protective Coatings  
Division

J - 13

**[ ] ONE-COAT TANK LINING FOR STORING AND TRANSPORTING EDIBLE FOOD PRODUCTS**

**[ ] MEETS FDA REQUIREMENTS**

**[ ] BACKED BY 25 YEARS OF DIMETCOTE'S PROVED-SUPERIOR PERFORMANCE**

▪ Delivers the superior corrosion protection of inorganic zinc silicate Dimetcote  
▪ Extremely tough and durable; highly abrasion resistant; insoluble in aromatic solvents  
▪ Excellent temperature resistance — withstands normal loading and unloading temperatures of oils  
▪ Safe, water-based coating — nonflammable — no explosion-proof equipment required  
▪ Economical maintenance — easily cleaned; easily repaired.

Complies with Section 121.2548, Food Additives Amendment to the U.S. Food, Drug and Cosmetic Act, when used for contact with dry food products or low moisture, low acid, edible oils.

**PRINCIPAL USES:**

Dimetcote 4 (Food Grade) was especially formulated for use as a tough, durable tank lining material for the storage and transportation of dry food products and low moisture, low acid, edible oils.

**SYSTEMS USING DIMETCOTE 4 (FOOD GRADE)**

**Immersion** — Cargo and Storage Tanks — 1 coat of Dimetcote 4 (Food Grade), 3 mils dry.

**Repair** — Dimetcote 4 (Food Grade) may be used to repair itself.

**RESISTANCE — When Used As A Single-Coat System**

This chart is only a guide. For specific recommendations contact Ameron.

**DRY BULK EDIBLES:** Dimetcote 4 (Food Grade) is suited to products, such as:

Flour	Wheat	Rye
Rice	Barley	Corn
Sugar	Oats	Grains

**VEGETABLE OILS:**\* This coating will provide excellent service when exposed to oils of low acid content, such as:

Almond	Kapok	Peanut
Castor	Linseed	Rapeseed
Coconut	Maize	Safflower
Corn	Mustard	Sesame
Cottonseed	Olive	Soyabean
	Palm Kernel	Walnut

\*See General Information Section.

**ANIMAL FATS AND OILS:**\* This product may be used to line tanks used for animal oils of low fatty acid concentration (less than 2.5%). Some of these oils are:

Cod Oil	Animal Grease*
Cod Liver Oil	Tallow*
Lard*	Whale Oil
General Fish Oil	

\*See General Information Section.

\*Products like these are likely to have a free fatty acid content higher than 2.5% because they are often stored and transported at high temperatures which tend to increase their acidity, especially near heating coils.

**LIQUID SUGARS AND SYRUPS:** Dimetcote 4 (Food Grade) is used to store and transport molasses which has a pH of 7.0 or higher. After carrying molasses, the tanks

must be washed thoroughly. Do not leave a dilute solution of molasses in the tanks. This product is not recommended for service in liquid sugar or sugar solutions.

**SOLVENTS:** Although designed for food grade service, Dimetcote 4 (Food Grade) may be exposed to products such as:

Alcohols	Glycerin	Chlorinated
Ketones	Esters	Hydrocarbons
Aviation	Toluol	(water-free)
Gasoline	Benzol	
Jet Fuels		

**WATER:** Dimetcote 4 (Food Grade) withstands intermittent exposure to fresh and salt water. However, it is not recommended for continuous immersion.

**TEMPERATURE RESISTANCE:** Excellent. Withstands normal loading and unloading temperatures of most edible oils.

**GENERAL INFORMATION:** Dimetcote 4 (Food Grade) like other inorganic zinc coatings is not recommended for service in strong acids or alkalis. Therefore, the coating's suitability for food products is dependent on the acidity of the products. For example, the percentage of free fatty acid in raw oils varies with the nature and quality of the oil and can change with age; to ensure long coating service life, the free fatty acid content of oil or fats must be less than 2.5%. Tanks should also be kept moisture-free during loading and water leaks must be avoided. Similarly, strong acidic or alkaline products should not be used to clean Dimetcote lined tanks.

**Ameron**

**DIMETCOTE® 4**

**FOOD GRADE**

**TYPE:** Water-Based, Self-Curing Inorganic Zinc

**USE:** Tank lining

**SUITABLE FOR:** Steel

<b>FINISH</b>	Matte
<b>COLOR</b>	Reddish-Gray
<b>DRY FILM THICKNESS PER COAT</b>	3 mils (4 mils max.)
<b>NO. OF COATS REQUIRED</b>	1
<b>TOTAL VOLUME SOLIDS*</b>	45.0%
<b>THEORETICAL COVERAGE* @ 1 MIL</b>	720 sq. ft./gal.
<b>THEORETICAL COVERAGE* @ 3 MILS</b>	240 sq. ft./gal.

\*See Amercoat Technical Report on Coverage of Inorganic Zincs. When computing working coverage, allow for application losses, surface irregularities, etc.

<b>NO. OF COMPONENTS</b>	2
<b>MIXING RATIO</b>	21 lbs. Powder to approx. 1/2 gallon Liquid
<b>POT LIFE @ 70°F</b>	72 hours
<b>APPLY OVER</b>	Dry-abrasive blasted steel
<b>APPLY BY</b>	Conventional spray (small areas — brush)
<b>DRYING TIME @ 70°F</b>	For Service: 24 hours
<b>TOPCOAT REQUIRED</b>	None
<b>THINNER</b>	Not recommended
<b>CLEANER</b>	Water

<b>TEMPERATURE RESISTANCE</b>	Up to 600°F (dry)
<b>FLASH POINT</b>	Nonflammable
<b>COMBUSTIBILITY</b>	Noncombustible
<b>WT. PER MIL-SQ. FT. OF DRY FILM</b>	Approx. 1/2 oz.

<b>PACKAGING</b>	1 gallon (Separate Powder & Liquid)
<b>SHIPPING WEIGHT</b>	Liquid — 7.26 lbs. Powder — 22 lbs.
<b>GUARANTEED SHELF LIFE FROM SHIPMENT DATE</b>	1 year

\*Volatiles Measurement Method

# DIMETCOTE 4 FOOD GRADE / APPLICATION INSTRUCTIONS

## SURFACE PREPARATION

1. **Round off** all rough welds and sharp steel edges. Remove weld spatter.
2. **Dry-abrasive blast**, including all pits and depressions; remove all mill scale, rust, grease, paint or foreign matter. Surface profiles from abrasive blasting should be similar to those obtained with fresh steel grit (G40), steel shot (S-230 size), graded flint or silica sand (30-60 mesh). If reusing blasting abrasives, clean them of contamination before using. Do not reuse sand or flint abrasive materials. Use air with minimum of 200 CFM per blast nozzle at minimum of 100 psi.
3. Apply Dimetcote 4 (Food Grade) as soon as possible to prevent blasted surfaces from rusting. Keep surfaces moisture free until coated. Keep oil, grease, or other organic matter off surface before coating. Spot reblast to remove any contamination; solvent-wiping is not satisfactory.

## EQUIPMENT REQUIRED

- Pressure material pot equipped with a mechanical agitator
- Separate air and fluid pressure regulators
- Air supply: at least 20 cu.ft./min. at 80 pounds pressure to each gun
- Air hose for the gun, 5/16" I.D.
- Material hose, 1/2" I.D.
- Industrial spray gun, such as DeVilbiss MBC 704E or 64E with 4165-403 nylon-tipped needle or Binks No. 18 with 66X63PB nozzle setup with 65N needle.
- Heavy mastic spring and leather or Teflon packing for the spray gun
- A 30 to 60-mesh metal screen or cheesecloth
- Dusting brush
- Fresh air mask for the operator, such as DeVilbiss P-MPH 527 and MPH 529, connected by 1/4" I.D. hose directly to air source
- Exhaust fan of sufficient capacity to keep the air relatively free of dust during blasting and coating operations

**WARRANTY:** Refer to Ameron's Terms and Conditions of Sale for warranty on this product

## APPLICATION PROCEDURE

1. Flush equipment with water.
2. Discard desiccant bag from powder can.
3. Stir total contents of each powder can slowly into total contents of each liquid can until well dispersed. Do not reverse order. Do not vary proportions.
4. Do not thin materials.
5. Strain mixture through 30-60 mesh screen to remove large particles.
6. Agitate material during application to ensure pigment suspension.
7. Remove all dust from surface to be coated.
8. Regulate air pressure: 50-75 psi to gun (with DeVilbiss equipment); 10-20 psi pot pressure. Note: Required pressures may vary with temperature and hose length.
9. Keep pressure pot at same elevation as spray gun.
10. Hold spray gun at right angles to work, and make even, parallel passes. Overlap each pass 50%.
11. Apply a heavy, wet coat to obtain 3 mils dry film thickness with no bare areas, pinholes or holidays. Maximum allowable dry film thickness is 8 mils.
12. Double-lap spray all welds, corners, edges, to ensure proper thickness.
13. Clean all spray equipment immediately after use with water.
14. Allow 2-3 hours drying time at 80°F and relative humidity of 85% to become water resistant. Higher temperatures speed drying, higher humidities retard drying. Below 50°F and RH above 80%, drying is greatly retarded. Do not apply Dimetcote 4 (Food Grade) to steel when surface temperature is less than 35°F.
15. Allow coating to dry a minimum of 24 hours at 70°F before placing in service.
16. Circulate fresh air continuously to speed up drying.
17. Longer time is needed to dry films thicker than 3 mils.
18. Repair any small damaged areas with brush or spray after first coat is dry-to-touch.
19. Before placing in service, water-wash Dimetcote film to remove dirt and loose contaminants. Dry tank thoroughly before using.

**WARNING:** Dimetcote 4 (Food Grade) Liquid may cause burns to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally. When handling, wear goggles or face shield. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

**Dimetcote 4 (Food Grade) Powder** is a harmful dust. Avoid breathing dust. Wash thoroughly before eating or smoking. Keep away from feed or food products.

If welding is to be performed in confined spaces, on steel coated with Dimetcote 4 (Food Grade), do so in accordance with instructions in U.S.A. Standard Z49.1-1967, "Safety in Welding and Coating."

Flashpoint

Nonflammable

**WARNING:** Do not leave mixed material in sealed container beyond the expected pot life as gassing may cause container to burst.

201 North Berry Street  
Brea, California 92621

**Ameron**

Protective Coatings  
Division

J - 15

R 4-79 Supersedes

R 2/79

## SELF- OR POST-CURING 100% INORGANIC ZINC COATING

- ☐ APPLIES EASILY AT HUMIDITIES FROM BELOW 50% TO 90% AND AT TEMPERATURES ABOVE 40°F

DRIES IN MINUTES; WATER INSOLUBLE WITHIN 1 HOUR AFTER APPLICATION

- ☐ NO SPECIAL SURFACE PREPARATION NEEDED BEFORE OVERCOATING

■ Ideal single coat protection in severe marine exposure and weathering ■ As a permanent primer, greatly prolongs topcoat life ■ Excellent temperature resistance ■ Exceptionally good adhesion to steel; bonds both chemically and physically ■ High metallic zinc content... provides cathodic protection to steel surfaces, including sharp edges, nuts and bolts ■ Inhibits corrosion in small abraded areas

### PRINCIPAL USES:

- ☐ Maintenance and Marine  
Severe weathering, including marine exposures, moderate chemical fumes, and abrasion on:

- Bridges ■ Piping Exteriors ■ Transmission Towers ■ Offshore Platforms
- Ship Decks and Superstructures ■ Marine Hulls Above Waterline
- Almost any Steel Structure Exposed to Severe Weathering and Salt Spray

Apply a single coat of Dimetecote 5 at 3 mils dry film thickness. Badly-pitted surfaces may require 3 to 5 mils dry. Dimetecote 5 may be overcoated with a recommended topcoat system for certain services, for appearance, or for visibility.

- ☐ Tank Lining

Continuous or Intermittent Service

- Storage in Process Tanks ■ Ship Cargo/Ballast Tanks
- Fuel Tanks ■ Solvent Tanks

single coat of Dimetecote 5 at 3 mils dry film thickness. No topcoat. Sharp edges, nuts, bolts, rough welds, or badly pitted surfaces may require 4 to 6 mils dry film thickness. Up to 8 mils dry film thickness is allowable.

- ☐ Permanent Primer

Severe chemical exposures, or mild acid or alkali fumes on:

- Structural Steel ■ Tank Exteriors ■ Almost Any Steel Surface Exposed to Severe Corrosion

Apply a single coat of Dimetecote 5 as primer 3 mils dry film thickness. Badly-pitted surfaces may require 3 to 5 mils dry film thickness. Overcoat with a suitable topcoat system.

NOTE: Obtain specific recommendation from Ameron.

### RESISTANCE — When Used Without A Topcoat

This chart is only a guide. For specific recommendations, refer to the Ameron Coatings Tank Lining Chart.

**WEATHER:** Outstanding resistance. No apparent loss of protective qualities after prolonged exposure.

**TEMPERATURE:** Exceptional resistance. Withstands continuous dry heat up to 600°F, and brief exposures to 800°F.

**ALCOHOLS:** Suitable for continuous immersion in alcohols:

Ethyl Butyl Propyl Octyl

**ALCOHOLS:** Ideally suited for atmospheric exposure to, and splash or spillage of alcohols, such as:

Ethyl Methyl Propyl

**PETROLEUM PRODUCTS:** Good resistance to splash, spillage, fumes or continuous immersion in petroleum hydrocarbons, such as:

Aviation Gasoline Jet Fuel Toluene Xylene

**SOLVENTS:** Resistant to splash, spillage, fumes or immersion in solvents, such as Ketones.

**ANIMAL AND VEGETABLE OILS:** Resistant to immersion in animal and vegetable oils of less than 2½% free fatty acid content.

**WATER:** Unharmful by atmospheric exposure or splash and spillage of salt and fresh water.

NOTE: As is true of all inorganic zinc silicate coatings, Dimetecote 5 is not recommended for immersion in, or spillage of, acid or alkali solutions.

# DIMETCOTE™ 5

## PROTECTIVE COATING

TYPE: Self-Cure or Post-Cure Water-Based Inorganic Zinc

USE: Maintenance, Marine, Permanent Primer

SUITABLE FOR: Steel

FINISH	Matte
COLOR	Reddish-Gray
RECOMMENDED DRY FILM THICKNESS PER COAT	3 Mils
NO. OF COATS REQUIRED	1
TOTAL DRY FILM THICKNESS DIMETCOTE 5	3 Mils
TOTAL VOLUME SOLIDS*	46.9%
THEORETICAL COVERAGE* @ 1 MIL	750 Sq. Ft. per Gal.
THEORETICAL COVERAGE* PER COAT @ 3 MILS	250 Sq. Ft. per Gal.
NO. OF COMPONENTS	2
MIXING RATIO	19.5 lbs. Powder: ¾ gal. Liquid
POT LIFE	8 hrs. @ 70°F (3 hrs. @ 90-100°F with continuous agitation, 5 hrs. without continuous agitation)
APPLY OVER	Dry-abrasive Blasted Steel
APPLY BY	Conventional Spray
DRYING TIME	Water Insoluble: Within 1 hr. @ 70°F, 50-95% humidity. Abrasion Resistant: 30 minutes @ 70°F, 50-90% humidity.
CURING TIME	To Topcoat: 24 hrs. @ 70°F and 50-90% humidity. To Recoat: dry to touch.
THINNER	None
CLEANER	Fresh Water

TEMPERATURE RESISTANCE	Continuous, up to 600°F dry; Intermittent, up to 800°F dry
FLASH POINT	Nonflammable
COMBUSTIBILITY	Noncombustible (NOTE: D-3 Standard Curing Solution, if used, is flammable)
WT. PER MIL/SQ. FT. OF DRY FILM	Approximately 0.5 oz.
ELECTRICAL CONDUCTIVITY	Low: Weak Conductor
PACKAGING	1 Gallon
SHIPPING WEIGHT	1's: approx. 8 lbs. Liquid; 20.5 lbs. Powder
GUARANTEED SHELF LIFE FROM SHIPMENT DATE	Liquid, 6 months Powder, 1 year

\*Volatiles Measurement Method

# DIMETCOTE™ 5 APPLICATION INSTRUCTIONS

## SURFACE PREPARATION

1. **Round off** all sharp edges and corners after welding. Remove weld spatter.
2. **Dry abrasive blast** on all surfaces to pits and depressions. Remove all oil, grease, dirt, rust, scale, paint or foreign matter. Surface prepared from abrasive blasting should be similar to that obtained with fresh steel grit 40/60 size (steel shot 80/100 size) or graded flint or silica sand 60/80 mesh. Use a minimum pressure of 100 psi at volume of 200 CFM minimum. If reusing grit or shot, clean them of contamination before reusing. Do not reuse sand or fine abrasives.

Where an automatic blasting unit is used, its manufacturer should be consulted for working abrasive mixtures and line pressures.

3. **Apply Dimetcote 5** as soon as possible to prevent blasted surfaces from rusting. Keep the surface oil, grease or other organic matter off surface before coating. **Spot reblast** to remove any contamination. Solvent wiping is not satisfactory.

## EQUIPMENT REQUIRED

- **Pressure material pot** with low speed agitator.
- **Separate atomizing air and fluid pressure regulator.**
- **Air supply:** Compressor capable of supplying continuous volume at 80 psi to nozzle of each gun (with Binks or DeVilbiss equipment).
- **Air hose** for gun, 5-16" I.D.
- **Material hose,** 1/2" I.D.
- **Industrial spray gun,** such as Eclipse GAT, with No. 40 stainless steel fluid tip and No. 17 or No. 27 fan slot nozzle, or DeVilbiss MBC or JGA 64E or 704E (for hot and windy weather, use 2E), leather needle packing and heavy mastic spring; or Binks No. 18 or 62 with 66X63PB nozzle setup (66X66P in hot and windy weather), with No. 54-839 mastic spring and No. 54-747 leather or No. 2-28 Teflon needle packing.
- **30-60 mesh metal screen.**

## SAFETY EQUIPMENT REQUIRED

(In Tanks or Confined Areas Only)

- **Fresh air mask,** such as DeVilbiss P-MPH 527 or MPH 529, connected by 1/2" I.D. hose directly to air source. Use ventilation during application to reduce dust in work area.

## APPLICATION PROCEDURE

1. **Keep cans out of sun** prior to mixing. Overheated material may gel.
  2. **Flush equipment** with fresh water before use.
  3. **Discard desiccant bag** from powder can.
  4. **Power stir slowly** the total contents of each powder can into total contents of each liquid can until well dispersed. **Do not reverse order. Do not vary these proportions. Slowly agitate** throughout application.
- NOTE:** Dimetcote 5 Liquid is black until mixed with Powder. Dry coating is reddish gray.
5. **Do not thin materials for any reason.**
  6. **Strain mixture** through 30-60 mesh screen to remove large particles.
  7. **Remove all dust** from surface to be coated.

**WARRANTY:** Refer to Ameron Terms and Conditions of Sale for warranty on this product.

8. **Regulate air pressure** to 20 psi at gun, 10-20 psi at pot with Binks. DeVilbiss, 85 psi at pot with Eclipse. **Note:** Higher air pressures may vary with temperature and humidity.

9. **Keep pressure pot** at about same level as gun.
10. **Hold spray gun** at right angle to work and make even, parallel passes. Overlap each pass 50%.
11. **Apply a heavy, wet coat** to obtain proper thickness without pinholes, bare areas or holidays.
12. **Double-lap spray** all welds, corners, seams, etc.
13. **Clean all spray equipment** with fresh water immediately after use.
14. **If greater thickness is desired,** recoat when first coat is dry to touch.

## CURING DIMETCOTE 5

### Self-Curing

1. **Allow to dry up to 1 hr.** at 70 F and 50-90% relative humidity for water insolubility. At 70 F and low humidities (below 50%), drying time for water insolubility is faster; with low temperatures (40-50 F) and low humidities, Dimetcote 5 dries somewhat slower. With lower temperatures and high humidities (50-90%), the coating is hard within 30-60 minutes and water insoluble in 2-3 hours.

2. **Recoating** may be done when first coat is dry to touch.

3. **Topcoat Dimetcote 5** with recommended topcoat after 24 hours at 70 F with relative humidity 50% or above.

### Post-Curing

1. **If post-curing is desired,** apply either D-3 Standard Curing Solution or D-3 Nonflammable Curing Solution in 1 coat by brush or spray. Allow Curing Solution to remain on surface 2 hrs.
2. **If post-cured Dimetcote 5 is to be topcoated,** scrub off all Curing Solution residue with water. Allow surface to dry thoroughly before topcoating.

**Repair cured Dimetcote 5** by spot reblasting or power tool cleaning. Apply additional Dimetcote 5 to original thickness.

**WARNING:** Dimetcote 5 Liquid may cause burns to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally. When handling, wear goggles or face shield. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

**WARNING:** Dimetcote 5 Powder is a harmful dust. Contains lead. Avoid breathing dust. Wash thoroughly before eating or smoking. Keep away from feed or food products.

If welding is to be performed in confined spaces on steel coated with Dimetcote 5, do so in accordance with instructions in U.S.A. Standard Z 49.1-1967, "Safety in Welding and Cutting."

**WARNING:** Do not leave mixed material in sealed container beyond the expected pot life as gassing may cause container to burst.

**Ameron**  
Protective Coatings  
Division



# Dimetcote® 6

Inorganic-zinc coating

AMERON

Can be applied at temperatures down to 0°F

Withstands water contact 15 minutes after application. Cures rapidly through a wide temperature range at up to 99% humidity

Excellent storage stability over a wide temperature range

Compatible with a wide variety of intermediate coats and topcoats

Meets nuclear power plant requirements

## Typical Uses

As a single-coat maintenance system or as a long-lasting primer for chemical exposures, preventing corrosion of tank exteriors, structural steel, piping, transmission towers, offshore platforms, bridges, fuel storage tanks, solvent tanks, marine hulls above waterline, marine structures.

## Outstanding Characteristics

Develops a tough, abrasion-resistant film in approximately two hours. Cures to permit topcoating after 24 hours. High-metallic zinc content provides long-lasting, cathodic protection to steel surfaces, including sharp edges, nuts, and bolts. Extremely resistant to severe chemical, nuclear radiation, and marine environments. Withstands intermittent contact with water, rain, or condensation 15 minutes after application.

Dimetcote 6 conforms to U.S. Navy Chapter 9190 as a self-curing, inorganic-zinc silicate coating approved for application to hulls above waterline, decks, and superstructures of U.S. Navy vessels.

ANSI N101 2-1972 -- Meets requirements for design basis accident conditions for pressurized water reactors and

boiling water reactors. American National Standard -- Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities.

## Resistance

Dimetcote 6 without a topcoat has excellent resistance to weathering, ultraviolet exposure, splash and spill of petroleum products, alcohols and solvents.

Primer/topcoat systems based on Dimetcote 6 and specified Amercoat® topcoats are suitable for severe corrosive services such as pulp and paper mills, petrochemical plants, marine hulls above the waterline, ship superstructures and decks, and offshore platforms.

## Topcoats

Dimetcote 6 may be topcoated with epoxies, vinyls, acrylics, chlorinated rubbers or others. Typical Ameron topcoats are Amercoat 383HS polyamide epoxy or Amercoat 99 high-build vinyl. Get specific recommendations from your Ameron representative.

**Note:** Like all inorganic zinc coatings, Dimetcote 6 alone is not suitable for immersion in or spillage of acid or alkaline solutions.

(over)

## Physical Data

Finish	Flat
Color	Reddish gray
Surface	Steel
Components	2
Cure	Solvent release and reaction with atmospheric moisture
Volume solids	66% (void content method)
Dry film thickness	2½ mils (65 µ)
Calculated coverage at	
1 mil (25 µ)	1060 sq ft gal (26 sq m ltr)
2½ mils (65 µ)	424 sq ft gal (10.4 sq m ltr)
Allow for application losses and surface irregularities.	
Coats	1
Application	Conventional spray
Pot life	24 hrs min. @ 70 F (21 C)
Drying time	
Water-insoluble	15 min above 32 F (0 C); 15-30 min @ 0-32 F (-18-0 C)
Abrasion-resistant	2 hrs @ 77 F (25 C)
To topcoat	24 hrs @ 77 F (25 C)
Pot life and drying time are influenced by temperature and humidity.	
Temperature limit	750 F (399 C) dry
Flash point	
(Tag Open Cup, ASTM D 1310) Mixed	77 F (25 C)
Thinner	
Amercoat 65	70 F (21 C)
Amercoat 101	Above 70 F (21 C)
Cleaner	Amercoat 12
Packaging	1- and 5-gal units
Shipping weight	
1-gal powder	16 lbs (7.3 kg)
1-gal liquid	7.5 lbs (3.4 kg)
5-gal powder	80 lbs (36.3 kg)
5-gal liquid	37 lbs (16.8 kg)
Shelf life	1 yr from date of shipment when stored indoors

Also available in an "E" version to comply with South Coast Air Quality Management District Rule 442 (formerly Rule 66) and equivalent regulations.

# Dimetcote® 6

## Application Data Summary

**Surface preparation** - Dry abrasive blast

**Equipment** - Standard industrial spray equipment.

**Safety** - Since improper use and handling of Dimetcote 6 can be hazardous to health and cause fire or explosion, safety precautions included with the application instructions must be strictly followed during storage, handling, application, and drying.

For complete information on procedures, equipment, and safety precautions, see Dimetcote 6 application instructions. Like all high performance coatings, Dimetcote 6 must be applied as recommended to obtain maximum performance.

## Warranty

Ameron's products are warranted to be free of defects in material or workmanship. If a product does not conform with this Warranty, Buyer must notify Ameron within five days of discovery of the defect, but in no event later than one year after delivery date, or after expiration of the applicable shelf life, whichever is shorter. Ameron's sole obligation under this Warranty shall be at its option, to credit Buyer's account, or to supply replacement material or repair. Failure to notify Ameron of nonconforming goods under this Warranty, within the time specified above, shall bar Buyer from recovery hereunder.

It is expressly understood that Ameron makes no other

warranties concerning the goods, and the sole remedy of the Buyer and the sole liability of Ameron for product defect shall be as set forth above. No other warranties, express or implied, whether of merchantability or of fitness for any particular use shall apply. Ameron shall not be responsible for consequential damages.

Any recommendation or suggestion relating to the use of the products made by Ameron either in technical literature or in response to specific inquiry is given in good faith, but it is for Buyer to satisfy itself of the suitability of the goods for its own particular purpose and it will be deemed to have done so.

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Protective Coatings  
Division

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## Product Data

### Dimetcote® 8

(Formerly No. 1674)

☐ SPECIALLY FORMULATED FOR PHENOL AND A VARIETY OF SOLVENTS AND CHEMICALS

☐ CAN BE CLEANED BY HOT WATER WASH, LOW PRESSURE EXHAUST STEAM OR BUTTERWORTH TECHNIQUE

COATING TYPE..... Inorganic Zinc Silicate  
USE..... Tank Lining  
COLOR..... Gray Matte  
RECOMMENDED DRY FILM THICKNESS PER COAT..... 3 Mils Maximum  
NUMBER OF COATS..... 1  
✓ TOTAL VOLUME SOLIDS..... 50.0%  
THEORETICAL COVERAGE\* @ 1 MIL..... 800 Sq. Ft. per Gal.  
THEORETICAL COVERAGE\* @ 3 MILS..... 267 Sq. Ft. per Gal.

\*When computing working coverages, allow for application losses, surface irregularities, etc.

NUMBER OF COMPONENTS..... 2  
MIXING RATIO..... 22.3 Lbs. Powder / 0.62 Gal. Liquid  
POT LIFE..... 8 Hrs. @ 70°F  
APPLY OVER..... Blasted Steel  
APPLY BY..... Conventional Spray  
DRYING TIME..... Before Applying Cure: 2 Hrs. @ 70°F  
CURING SOLUTIONS..... D-3 Standard or D-3 Nonflammable  
CURING TIME..... For Service: 24 Hrs. Minimum  
THINNER REQUIRED..... None  
CLEANER REQUIRED..... Fresh Water  
FLASH POINT..... D-3 Standard Curing Solution: 80°F Tag Open Cup  
COMBUSTIBILITY..... Nonflammable with D-3 Nonflammable Curing Solution  
WT. PER MIL SQ. FT. OF DRY FILM..... Approx. 0.5 oz.  
PACKAGING..... Dimetcote 8: 1 Gal. (Separate Liquid and Powder)  
D-3 Standard Curing Solution: 1 & 5 Gal.  
D-3 Nonflammable Curing Solution: 5 Gal.  
SHIPPING WEIGHT..... Dimetcote 8: Approx. 23.5 Lbs. Powder, 8.0 Lbs. Liquid  
D-3 Standard Curing Solution: Approx. 9.0 Lbs. 5's  
Approx. 45.0 Lbs.  
D-3 Nonflammable Curing Solution: 5's - Approx. 53.5 Lbs.  
GUARANTEED SHELF LIFE..... 1 Year all components from date of shipment, stored indoors  
@ 40° - 100°F.

Note: Not suitable for ballast service.

## RESISTANCE—When Used As A Tank Lining

This chart is only a guide. For specific recommendations, contact Ameron.

**PHENOL:** Withstands continuous immersion in phenol.

**NOTE:** Test before actual use to establish suitability for specific phenol color stability requirements.

**ALCOHOLS:** Insoluble in splash, spillage, fumes or continuous immersion in alcohols, such as

Methyl  
Ethyl

Propyl  
Butyl

**PETROLEUM PRODUCTS:** Completely insoluble in splash, spillage, fumes or continuous immersion in

Petroleum Hydrocarbons  
Oils

Lubricants  
Motor Fuels  
Jet Fuels

Aviation Gasoline  
Crude Oils

**SOLVENTS:** Insoluble in fumes, splash, spillage or continuous immersion in ketones, esters, chlorinated hydrocarbons and aromatic solvents such as:

Toluol

Benzol

Xylof

**ANIMAL AND VEGETABLE OILS:** Resistant to animal and vegetable oils of less than 2% acid content

**NOTE:** Dimetcote 8 is not recommended for immersion in, or spillage of, acid or alkali solutions. Not recommended for immersion in fresh or seawater.

## APPLICATION INSTRUCTIONS

### Surface Preparation

1. Round off all rough welds and sharp steel edges. Remove weld spatter.
2. Dry-abrasive blast to "white metal," according to Steel Structures Painting Council Specification SP 5-63. Blast only with steel grit (G-40 size), steel shot (S 230 size), or graded flint or silica sand (30-60 mesh). If reusing steel grit or shot, clean them of contamination before reusing. Do not reuse sand or flint abrasive material. Use air of 100 psi.
3. Apply Dimetcote 8 as soon as possible to prevent blasted surfaces from rusting. Keep surfaces moisture-free until coated. Keep oil, grease or other organic matter off surface before coating. Spot reblast to remove any contamination, don't solvent wipe.

### Equipment Required

Pressure material pot with mechanical agitator.

Separate atomizing air and fluid pressure regulators.

Air supply: continuous volume at 80 psi minimum to each gun nozzle.

Air hose for gun, 5/16" I.D.

Material hose, 1/2" I.D.

Industrial spray gun, such as Eclipse GAT with No. 40 stainless steel fluid tip, No. 17 or No. 27 fan slot nozzle, or DeVilbiss MBC 765E or 62E with leather or Teflon needle packing and heavy mastic spring, or Binks No. 18 or No. 66 fluid nozzle and No. 63PB air nozzle with No. 54 839 mastic spring and No. 54 747 leather or 2 28 Teflon needle packing.

30-60 mesh metal screen.

#### Safety Equipment Required

(In Tanks or Confined Area Only)

Fresh air mask, such as DeVilbiss P-MPH 527 and MPH 529, connected by 1/4" I.D. hose to air source.

If D-3 Standard Curing Solution is used, exhaust fan of sufficient capacity to keep solvent vapors below 20% of the explosive limit or 1% by volume of solvent vapor in the air.

Tank Size	Required Blower Size
100 to 5,000 Gal.	1,000 cu. ft./min.
5,000 to 20,000 Gal.	2,000 cu. ft./min.
20,000 to 100,000 Gal.	5,000 cu. ft./min.

Use ventilation during all applications to reduce dust.

#### Application Procedure

1. Flush equipment with fresh water before use.
2. Discard desiccant bag from powder can.
3. Stir total contents of each powder can slowly into total contents of each liquid can until well dispersed. Do not reverse order. Do not vary proportions.
4. Do not thin for any reason.
5. Strain mixture through 30-60 mesh screen.
6. Agitate mixed material throughout application.
7. Remove all dust from surfaces to be coated.
8. Regulate air pressure: 50-75 psi to gun, 10-20 psi to pot with Binks or DeVilbiss, 35 psi to both pot and gun with Eclipse. Note: required pressures may vary with temperature and hose length.
9. Keep pressure pot at same elevation as spray gun.
10. Hold spray gun at right angles to work, and make even, parallel passes. Overlap each pass 50%.
11. Apply a heavy, wet coat to obtain proper thickness with no bare areas, pinholes or holidays.
12. Double lap spray all welds, corners, edges, etc.
13. Check dried film with dry film thickness gauge. If less than 3 mils, apply extra material up to required thickness before curing.

14. Clean equipment immediately after use with fresh water. Unused mixed coating material can be chilled and used next day after thorough stirring.

**WARNING:** Do not leave mixed material in sealed container beyond expected pot life as gassing may cause container to burst.

15. Keep moisture off surface until after curing.

#### Curing Dimetecote 8

##### Using D-3 Standard Curing Solution

1. Apply curing solution heavily by brush or spray 2 hrs. after Dimetecote 8 has been applied.
2. Allow curing solution to remain on surface at least 24 hours. Air temperature should be above 40°F.

##### Using D-3 Nonflammable Curing Solution

1. Apply curing solution same as with standard curing solution, except: apply a light coat, allowing it to become tacky (15-60 minutes). Then apply balance of curing solution.
2. If puddles of curing solution develop, disperse promptly with air hose, brush or mop.

After 24 hours but before service, the residue of curing solution should be removed as soon as possible by flushing the surface with fresh water or by steaming. Scrubbing with stiff bristle brush will remove heavy deposits.

To repair coating after it has been cured, spot reblast. Apply material with spray or brush and cure when dry.

**WARNING:** Dimetecote 8 Liquid may cause burns to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally. When handling, wear goggles or face shield. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

**WARNING:** Dimetecote 8 Powder is a harmful dust. Avoid breathing dust. Wash thoroughly before eating or smoking. Keep away from feed or food products.

**WARNING:** D-3 Standard Curing Solution is flammable and causes skin and eye irritation. Keep away from heat and open flame. Keep container closed. Use with adequate ventilation. Avoid prolonged breathing of vapor. Avoid contact with skin or eyes. Do not take internally. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention. In tanks and other confined areas, observe the following precautions to prevent hazards of fire or explosion or damage to the health: (1) circulate adequate fresh air continuously during application and drying, (2) use fresh air masks and explosion-proof equipment, (3) prohibit all flames, sparks, welding and smoking.

**CAUTION:** D-3 Nonflammable Curing Solution causes skin and eye irritation. Avoid contact with skin or eyes. Do not take internally. In case of contact, flush skin with plenty of water; for eyes, flush with plenty of water for 15 minutes and get medical attention.

If welding is to be performed in confined spaces on steel coated with this product, do so in accordance with instructions in U.S.A. Standard Z 49.1-1967, "Safety in Welding and Cutting."

**WARRANTY:** Refer to Ameron's Terms and Conditions of Sale for warranty on this product.

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**Ameron.**  
Protective Coatings  
Division

R4/79 Supersedes  
R11/72

# Dimetcote 9

Inorganic-zinc coating

AMERON

**A heavy-duty primer that protects with just a single coat**

**Outstanding application characteristics over a wide range of atmospheric conditions**

**Can be applied by airless or conventional spray leaving a smooth film with negligible overspray even in hot weather**

**Excellent heavy-build film tolerance in corners and angles**

**High-metallic zinc content provides long-term corrosion protection that reduces maintenance costs**

**Abrasion resistance and minimum burn-back during welding reduce touch-up requirements**

**Applied over blasted or pickled surfaces**

## Typical Uses

As a single coat, Dimetcote 9 resists severe weathering and marine environments. As a primer with recommended topcoats, Dimetcote 9 is resistant to industrial chemical exposure as well as marine exposure above the saltwater splash zone, structural steel and piping, tank exteriors, bridges, offshore platforms, marine hulls above waterline, superstructures and decks.

## Resistance

Dimetcote 9 without a topcoat has excellent resistance to weathering and ultraviolet exposure, water and neutral salts, refined petroleum products, alcohols and solvents, animal and vegetable oils (up to 2½% free fatty acid). In addition to the above, with suitable topcoats Dimetcote 9 is recommended for fumes and splash of mild alkalis, dilute acids (fumes only), salt solutions of most types

Dimetcote 9 is not recommended for immersion service or spillage of acid or alkaline solutions. For specific

recommendations, consult your Ameron representative

## Topcoats

Dimetcote 9 may be topcoated with epoxies, vinyls, acrylics, chlorinated rubbers, or other topcoats when used in industrial or marine maintenance systems. Typical Ameron topcoats are Amercoat 383HS polyamide epoxy or Amercoat 99 high-build vinyl

## Application Data Summary

**Surface preparation** — Dry abrasive blasting or pickling.

**Equipment** — Standard industrial spray equipment, either conventional or airless.

**Drying times** — at 77°F (25°C) and 50 to 90% relative humidity applied without thinning at recommended dry film thickness

To touch	10 minutes
Dry through	18 minutes
To topcoat	24 hours (with most topcoats)

For complete information on procedures, equipment, and safety precautions, see the application instructions. Like all high-performance coatings,

## Physical Data

Finish	Flat
Color	Green
Surface	Steel
Components	2
Cure	Solvent release and reaction with atmospheric moisture
Volume solids	62% (void content method)
Dry film thickness	2½ mils (65 µ)
Coats	1
Calculated coverage at	
1 mil (25 µ)	992 sq ft gal (24.3 sq m ltr)
2½ mils (65 µ)	397 sq ft gal (9.7 sq m ltr)
Allow for application losses	and surface irregularities.
Application	Airless or conventional spray
Pot life	24 hrs @ 77 F (25 C)
Dry-through	
(ASTM D 1640)	18 min @ 77 F (25 C) and 50-90% R.H.
Temperature limit	750 F (399 C) dry
Flash point	
(Setaflash Closed Cup,	
ASTM D 3278) Mixed	58 F (14 C)
Zinc in dry film	88.3% by weight
Thinner	
Amercoat 65	70 F (21 C)
Amercoat 101	Above 70 F (21 C)
Cleaner	Amercoat 12
Use "E" version thinner and cleaner in air pollution control areas.	
Packaging	1- and 5-gal units
Shipping weight	
1-gal liquid	6.5 lbs (3.0 kg)
1-gal powder	17 lbs (7.7 kg)
5-gal liquid	32.5 lbs (14.8 kg)
5-gal powder	85 lbs (38.6 kg)
Shelf life from shipment date	Stored indoors @ 40-100 F (5-38 C) Powder - 2 years; Liquid - 9 months

Complies with South Coast Air Quality Management District Rule 442 (formerly Rule 66) and equivalent regulations applicable to surface applied coatings and solvents

# Dimetcote 9FT

Inorganic-zinc coating

AMERON

**Fast drying properties permit quick handling and fast topcoating**

**Can be applied by airless or conventional spray leaving a smooth film with negligible overspray even in hot weather**

**Excellent tolerance to heavy film build in corners and angles**

**Outstanding application characteristics over a wide range of atmospheric conditions**

**Meets or exceeds requirements of Steel Structures Painting Council Specification PS 12.00 for inorganic zinc coatings**

**Meets selected state specifications for inorganic zinc priming of bridges**

## Recommended Uses

Dimetcote 9FT is designed for use as a fast-drying shop primer for shop-fabricated steel, allowing quick steel handling and shop topcoating with a specified fast-drying topcoat. It can also be field topcoated in the construction completion stage. Dimetcote 9FT may be field-applied and topcoated with a variety of Amercoat topcoats. Dimetcote 9FT displays versatile application properties and is especially suitable for use with airless spray equipment. Its film thickness tolerance of 8 mils without cracking facilitates proper application to structural shapes.

When used as a primer in a fast-dry system, Dimetcote 9FT is topcoated with Amercoat® 350FD fast-dry epoxy following the topcoating schedule shown. Dimetcote 9FT is also designed to meet a number of state Bridge and Highway Department specifications for inorganic zinc primers to be applied to bridges and related structures. When used for this purpose, Dimetcote 9FT may be either shop- or field-applied.

Dimetcote 9FT is also suitable for general purpose industrial

maintenance priming in corrosive atmospheric exposures where inorganic zinc primers are normally recommended and topcoated with corrosion-resistant topcoats.

Dimetcote 9FT may be topcoated with epoxies, vinyls, acrylics, chlorinated rubbers, or other topcoats when used in industrial or marine maintenance systems. Typical Ameron topcoats are Amercoat 383HS polyamide epoxy or Amercoat 99 high-build vinyl. Get specific recommendations from your Ameron representative.

Dimetcote 9FT complies with (California) South Coast Air Quality Management District Rule 442 (formerly Rule 66) and equivalent regulations covering use of surface-applied coatings and solvents.

## Resistance Guide

Dimetcote 9FT without a topcoat has excellent resistance to weathering, ultraviolet exposure, splash and spill of petroleum products, alcohols, and solvents.

Primer topcoat systems based on Dimetcote 9FT and specified Amercoat topcoats are suitable for severe corrosive services.

## Physical Data

Finish .....	Flat
Color .....	Green
Surface .....	Steel
Components .....	2
Cure .....	Solvent release and reaction with atmospheric moisture
✓ Volume solids .....	61% (ASTM D 2697)
Dry film thickness .....	2½ mils (65µ)
Coats .....	1
Application .....	Airless or conventional spray
Pot life .....	24 hrs @ 77°F (25°C) minimum
Dry through (ASTM D 1640) .....	18 min @ 77°F (25°C) and 50-90% R.H.
Calculated coverage at	
1 mil (25µ) .....	978 sq ft gal (24 sq m/ltr)
2½ mils (65µ) .....	391 sq ft gal (9.6 sq m/ltr)
Allow for application losses and surface irregularities.	
Temperature resistance	750°F (400°C) dry
Flash point	
Setaflash	
Closed Tester	
ASTM D 3278) Mixed	59°F (15°C)
✓ Zinc in dry film .....	76% by weight
Thinner	
Amercoat 65 .....	70°F (21°C) or below
Amercoat 101 .....	Above 70°F (21°C)
Cleaner .....	Amercoat 12
Use "E" version thinner and cleaner in air pollution control areas.	
Packaging .....	1- and 5-gallon units
Shipping weight	
1-gal liquid .....	9 lbs (4.1 kg)
1-gal powder .....	11 lbs (5.0 kg)
5-gal liquid .....	45 lbs (20 kg)
5-gal powder .....	55 lbs (25 kg)
Shelf life from shipment date .....	Stored indoors @ 40-100°F (5-38°C) Powder—2 years; Liquid—9 months



# Dimetcote<sup>®</sup> 9FT

such as pulp and paper mills, petrochemical plants, marine hulls above the waterline, ship super-structures and decks, and offshore platforms.

Dimetcote 9FT is not recommended for immersion service.

## Application Data Summary

For complete information on procedures, equipment, and safety precautions, see the application instructions. Like all high-performance coatings, Dimetcote 9FT must be applied as recommended to obtain the maximum protection for which this coating is formulated.

**Surface preparation** — Dry abrasive blasting or pickling.

**Equipment** — Standard industrial spray equipment, either conventional or airless.

**Safety** — Since improper use and handling of Dimetcote 9FT can be hazardous to health and cause fire or explosion, safety precautions included with the application instructions should be observed during all storage, handling, use, and drying periods.

## Warranty

Ameron's products are warranted to be free of defects in material or workmanship. If a product does not conform with this Warranty, Buyer must notify Ameron within five days of discovery of the defect, but in no event later than one year after delivery date, or after expiration of the applicable shelf life, whichever is shorter.

Ameron's sole obligation under this Warranty shall be at its option, to credit Buyer's account, or to supply replacement material or repair. Failure

to notify Ameron of nonconforming goods under this Warranty, within the time specified above, shall bar Buyer from recovery hereunder.

It is expressly understood that Ameron makes no other warranties concerning the goods, and the sole remedy of the Buyer and the sole liability of Ameron for product defect shall be as set forth above. No other warranties, express or implied, whether of merchantability or of fitness for any particular use shall apply. Ameron shall not be responsible for consequential damages.

Any recommendation or suggestion relating to the use of the products made by Ameron either in technical literature or in response to specific inquiry is given in good faith, but it is for Buyer to satisfy itself of the suitability of the goods for its own particular purpose and it will be deemed to have done so.

## Drying and Curing Times at 2½ mils (65 microns)

	Surface Temperature	Relative Humidity	Time
To touch *	65-80° F (18-27° C)	50-90%	8-10 minutes
To handle or dry through *	65-80° F (18-27° C)	50-90%	18-20 minutes
To topcoat with standard topcoats	above 70° F (21° C) 40-70° F (5-21° C)	50-90% 50-90%	16 hours 24 hours
To topcoat with Amercoat 350FD	80-100° F (27-37° C) 60-80° F (15-27° C)	50-90% 50-90%	3 hours 4 hours
fast-dry epoxy	40-60° F (5-15° C)	50-90%	6 hours

\* As defined in ASTM D 1640

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## Product Data

DIMETCOTE<sup>(a)</sup> 10

- Self-curing, Water-based Inorganic Zinc Coating
- Nonflammable and Heat-resistant
- Abrasion-resistant and Solvent-resistant
- Protects Against Marine Atmospheres and Weathering

---

### TYPICAL USES

Bridges, transmission towers, tank linings, offshore platforms, ship decks and superstructures, ship hulls above the waterline, and other structures exposed to severe weathering or salt spray.

### OUTSTANDING CHARACTERISTICS

Dimetcote 10 is a long-lasting, heavy-duty coating designed for severe marine and industrial atmospheres. It is used as a single coat or as a primer in a coating system. It dries in minutes, and is water-insoluble within one hour of application. Although this product is self-curing, it can be post-cured to achieve early water resistance during periods of high humidity (95 percent or higher). No special surface preparation is needed before overcoating.

When used as part of a system, it greatly prolongs topcoat life by preventing under-film corrosion. It is heat-resistant, and can be used as a stack coating on equipment that operates at temperatures up to 750°F (399°C). The high metallic zinc content provides cathodic protection for steel surfaces, including sharp edges and small abraded areas. Dimetcote 10 contains no lead. It is nonflammable, either in the dry state or liquid state.

Dimetcote 10 is an excellent tank lining because it is insoluble in organic solvents, including jet fuel, gasoline, and a wide range of petrochemicals; it is also suitable for many dry cargos.

In acidic or alkaline atmospheres, Dimetcote 10 must be topcoated. Suitable topcoats are epoxies, vinyls, chlorinated rubbers, phenolics, epoxy esters, and acrylics.

### PHYSICAL DATA

Finish. . . . . Flat  
Color . . . . . Reddish Gray  
Dry film thickness. . . . . 3 to 5 mils (75 to 125 mu) per coat  
Coats . . . . . 1

Calculated coverage . . . . 333 sq. ft./gal (8.2 sq. m/ltr) at 3 mils (75 µm);  
199 sq. ft./gal (4.9 sq. m/ltr) at 5 mils (125 µm)

Allow for application loss and surface irregularities.

Components. . . . . 2

Mixing ratio . . . . . 21 lbs (9.5 kg) powder to 2/3 gal. (2.5 ltr) liquid

Pot life . . . . . 72 hours at 70°F (21°C)

Surface . . . . . Steel (sandblasted)

Application . . . . . Conventional spray

### Drying time

Water-insoluble . . . . . 1 hr. at 70°F (21°C), 50 to 90% humidity

Abrasion-resistant. . . . 1/2 hr. at 70°F (21°C), 50 to 90% humidity

Curing time

To topcoat . . . . . 24 hrs. at 70°F (21°C), 50 to 90% humidity

To recoat . . . . . 6 to 8 hours at 70°F (21°C), 50 to 90% humidity

Thinner . . . . . None

Cleaner . . . . . Fresh water

Temperature resistance . . 750° (399°C)

Flash point . . . . . Nonflammable

Packaging . . . . . 1-gallon and 5-gallon units

Shipping weight . . . . . 1-gallon unit approximately 29 lbs (13.2 kg)

Shelf life. . . . . Liquid 1/2 yr.; powder 1 yr. from shipment date  
when stored indoors at 40 to 100°F (5 to 33°C)

This product complies with South Coast Air Quality Management District Rule 102 (formerly Rule 66) and equivalent regulations applicable to surface-applied coatings and solvents.

## APPLICATION DATA SUMMARY

Both temperature and humidity affect the rate of drying. Normal conditions for application of Dimetcote 10 are 50 to 95°F (10 to 35°C) surface temperature and 50 to 90% humidity. For complete information on procedures, equipment, and safety precautions, see detailed Application Instructions. Like all high-performance coatings, Dimetcote 10 must be applied as recommended to obtain the maximum performance.

**Surface Preparation:** For immersion and other severe service, sandblast to white metal. For nonimmersion or moderate service, sandblast to near-white metal.

**Equipment:** Conventional spray equipment is recommended. Brush and roller may also be used on a limited basis for small areas and for touch up.

## SAFETY

Since improper use and handling of Dimetcote 10 can be hazardous to health, safety precautions included with the Application Instructions must be observed during all storage, handling, use, and drying periods.

NOTICE - This product is for industrial use only.

WARRANTY:

Ameron's products are warranted to be free of defects in material or workmanship. If a product does not conform with this Warranty, Buyer must notify Ameron within five days of discovery of the defect, but in no event later than one year after delivery date, or after expiration of the applicable shelf life, whichever is shorter. Ameron's sole obligation under this Warranty shall be at its option, to credit Buyer's account, or to supply replacement material or repair. Failure to notify Ameron of nonconforming goods under this Warranty, within the time specified above, shall bar Buyer from recovery hereunder.

IT IS EXPRESSLY UNDERSTOOD THAT AMERON MAKES NO OTHER WARRANTIES CONCERNING THE GOODS, AND THE SOLE REMEDY OF THE BUYER AND THE SOLE LIABILITY OF AMERON FOR PRODUCT DEFECT SHALL BE AS SET FORTH ABOVE. NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR USE SHALL APPLY. AMERON SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL DAMAGES.

ANY RECOMMENDATION OR SUGGESTION RELATING TO THE USE OF THE PRODUCTS MADE BY AMERON EITHER IN TECHNICAL LITERATURE OR IN RESPONSE TO SPECIFIC INQUIRY IS GIVEN IN GOOD FAITH, BUT IT IS FOR BUYER TO SATISFY ITSELF OF THE SUITABILITY OF THE GOODS FOR ITS OWN PARTICULAR PURPOSE AND IT WILL BE DEEMED TO HAVE BEEN SO DONE.

SPECIFICATIONS

INORGANIC ZINC SILICATE PAINT

1.0 Description

The inorganic zinc silicate paint shall be a two-component self-curing type which, when mixed and applied in accordance with the manufacturer's instructions, cures without the use of a separate curing solution, and shall have the properties described herein. The inorganic zinc silicate coating shall have been commercially available and used by industry in actual application on exposed steel structures for at least 12 years prior to January 1, 1973 in a coastal or marine environment.

2.0 Composition

2.1 Pigment

The zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 96 percent metallic zinc and a minimum of 98 percent total zinc. The average particle size of the zinc powder shall not exceed 9.5 microns as determined by the Fisher Sub-sieve sizer. The zinc powder shall have a specific gravity of 7.00 to 7.15 as determined using the procedure set forth in ASTM Designation D135. All other fillers contained in the pigment shall be inert substances.

2.2 Vehicle

The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate alcohol solvent.

Vehicle Composition and Properties

Nonvolatile at 105°C for 3 hours, percent by weight	37 - 40
SiO <sub>2</sub> percent by weight of vehicle (without pigments)	11.0 - 12.0
Weight per gallon, pounds at 77°F	8.8 - 9.2
Storage life of vehicle at 77°F months minimum	12

2.3 Mixed Paint

Properties of Mixed Paint

- (a) The total zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.
- (b) The total solids, when heated at 105°C for 3 hours shall be not less than 80 percent by weight.

SPECIFICATIONS  
INORGANIC ZINC SILICATE PAINT

- (c) The paint shall tolerate up to one percent water contamination by weight without gellation.
- (d) The usable pot life of the mixed paint shall be not less than 8 hours at 77°F. There shall be no hard settling which cannot be easily redispersed during the period.
- (e) When applied by spray to panels prepared as shown in Section 3.0 (a) at a dry film thickness of 6.0 mils minimum, the film shall exhibit good adhesion and when observed with the unaided eye shall be free from cracks.
- (f) Weight per gallon, pounds at 77°F                      21.0 - 22.5

2.4 Color

The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces ~~and with the vinyl finish coat.~~

3.0 Resistance

Test panels of steel meeting the requirements of ASTM D 609-61 (1966) having dimensions of 2 inches by 5 inches by 1/8 inch, shall be prepared by cleaning all surfaces as designated in paragraph (a) below. A three mil coating (dry thickness) shall be applied to the test plates in accordance with the manufacturer's current printed instructions. The coating shall be cured as recommended by the manufacturer. Each of the following tests shall be performed. If any individual test panel fails any of the following tests, the material will not be accepted.

- (a) Surfaces to be painted with inorganic zinc paint shall be blast cleaned with abrasives producing a nominal height of Profile of 1.5 mils. The blast cleaned surfaces shall meet the following requirements:
  - (1) All oil, grease, dirt, rust scale and other foreign matter shall be completely removed except as hereinafter modified.
  - (2) All rust, mill scale and old paint shall be removed.
  - (3) At least 95 percent of each square inch shall be free of all visible residues and the remainder shall be limited to the light discoloration.
  - (4) Surfaces shall be cleaned to a condition at least equal to the appearance of the pictorial surface preparation standard, labeled Sa 2-1/2 in ASTM D2200-67, that applies to the starting rust grade of the steel.

Surfaces cleaned to meet Steel Structures Painting Council Specification SSPC-SP10-63 will meet these requirements.

## SPECIFICATIONS

### INORGANIC ZINC SILICATE PAINT

#### 3.1 Fresh Water Resistance

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening when examined after 30 days.

#### 3.2 Salt Water Resistance

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replenished with fresh solution after each examination.

#### 3.3 Weathering Resistance

Panels shall be tested in accordance with ASTM G 23-69, Type D. The panels shall be placed on test at the beginning of the wet cycle. After 1,000 hours continuous exposure, the coating shall show no rusting, loss of adhesion to the steel test panel or blistering.

#### 3.4 Salt Fog Resistance

Panels shall be scribed with an X or at least 2 inch legs down to the base metal. The test panels shall then be tested in accordance with ASTM B 117-64. After 1,000 hours of continuous exposure, the coating shall show no loss of bond, nor shall it show rusting or blistering beyond 1/16 inch from the center of the scribe mark.

#### 3.5 Resistance to Elevated Temperatures and Thermal Shock

Panels shall be exposed to a temperature of  $500^{\circ}\text{F}$  for one hour, then quenched immediately in  $65^{\circ}\text{F} \pm 5^{\circ}\text{F}$  water. Panels subjected to this test shall show no blistering or flaking of the coating.

#### 4.0 Packaging and Labeling

Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle, will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint, the lot number, and date of manufacture. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

#### 5.0 Application

The manufacturer's current printed instructions for application of inorganic zinc coating shall be submitted to the Highway Department for review and approval.

## SPECIFICATIONS

100 b o l w c

### VINYL FINISH COATING

#### 1.0 Description

Vinyl paint shall display compatibility with and adhesion to the cured inorganic zinc paint when applied directly over the inorganic zinc paint in accordance with the vinyl paint manufacturer's current printed instructions which shall be furnished to the State Highway Department.

#### 2.0 Composition

##### 2.1 Vehicle

The vehicle shall consist essentially of vinyl chloride copolymer resins dissolved in suitable solvents. Sufficient plasticizers shall be included to insure that the paint film will have adequate tensile strength.

##### 2.2 Mixed Paint

2.2.1 Vinyl paint shall contain not less than 29 percent pigment by weight and 19 percent vehicle solids by weight, for a total solids content of not less than 48 percent by weight. Total weight per gallon at 77°F shall be  $10.0 \pm 1.0$  pounds.

2.2.2 Vinyl paint shall be supplied in a single package. It shall be well ground and shall not be caked, livered, skinned, or badly settled in the container. All containers shall be cleaned of any paint spilled during filling operations. Containers shall bear a label on which shall be clearly shown the name of the manufacturer, the kind of paint, the lot number, date of manufacture, and complete instructions for their use.

##### 2.3 Color

The vinyl finish coat shall be light green, matching color No. 24260 of Federal Standards No. 595a dated January 2, 1968.



MANUFACTURER AND BRAND NAME APPROVAL  
FOR INORGANIC ZINC PAINT AND VINYL PAINT

Prior to approval and use of any inorganic zinc, the manufacturer shall submit to the State Highway Department a certified test report from an approved independent testing laboratory showing specific test results conforming to all quantitative requirements and resistance test requirements of these specifications. In addition, the certified test report shall contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. Upon approval by the State Highway Department of this certified test report, further resistance tests will not be required, except as hereinafter noted, of that manufacturer for that brand name of paint for a period of two years from the date of test completion. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the State Highway Department when random sampling and testing of material offered for use indicated nonconformance to any of the requirements herein specified.

To obtain final acceptance of inorganic zinc or vinyl paint, the manufacturer shall furnish a certification in triplicate certifying that the materials supplied conform to all of the requirements specified, and for the inorganic zinc primer, stating that the material is formulated the same as the material tested for manufacturer and brand name approval. The State Highway Department reserves the right to sample and test any or all materials supplied.

**Formula E-303b EPOXY ZINC-RICH PAINT\***

May be used in areas where air pollution regulations are in effect.

Ingredients	% by Weight	Pounds	Gallons
<b>COMPONENT A</b>			
Epoxy Resin, Type I	32.3	277.8	28.06
Nitropropane Solvent	44.0	378.6	45.62
Toluene	8.1	69.4	9.59
Ethylene Glycol Monoethyl Ether	8.1	69.6	8.96
Suspending Agent M	5.8	50.0	6.89
Phthalo Green Pigment	1.8	15.0	0.88
<b>COMPONENT B</b>			
Polyamide Resin	36.4	277.8	33.88
Isopropanol	23.8	182.2	27.86
Toluene	12.1	92.6	12.79
Nitropropane	26.6	203.1	24.47
Catalyst	1.1	8.1	1.00
<b>COMPONENT C</b>			
Zinc Dust Pigment	100.0	5,000.0	85.32

**Packaging and Labeling** Comp. A, B and C be packaged separately as kits; std. kit size 2.85 gallons (mixed paint volume), consisting of 1 gal. Comp. A, 1 gal. Comp. B, 50 lbs. Comp. C (packaged in a 2-gal. pail); each container to be labeled with Mixing instructions see full spec. for details; Pot life 24 hrs. but less in hot weather.

\* Do not meet air pollution regulations in certain states; if a variance cannot be obtained from the local air pollution control agency, these materials cannot be used.

SUPPLEMENT  
TO  
REVIEW OF SPECIFICATIONS  
FOR ZINC-RICH PAINTS  
ARTECH Report No. J7600.159-FR

Additional Specifications and Responses Received  
After Completion of Report

To  
February 20, 1980

	<u>Page</u>
Federal Specification TT-P-1561A	S - 2
Arizona	S - 11
District of Columbia	S - 18
Kentucky	S - 19
Louisiana	S - 22
Massachusetts	S - 37
New York	S - 44
Oregon	S - 45
South Dakota	S - 80
Virginia	S - 81
Washington	S - 83
West Virginia	S - 89
Wisconsin	S - 95
Wyoming	S - 96
New Jersey Zinc Corp.	S - 97

This supplement should be inserted in  
Volume II of the Report, following Appendix J.

OCT. 24 1970

TT-P-1561A  
AMENDMENT-1  
June 23, 1977

FEDERAL SPECIFICATION

PAINT, ZINC-ALUMINUM, RUST-INHIBITIVE  
(FOR RUSTY-GALVANIZED AND OTHER METAL SURFACES)

This amendment, which forms a part of Federal Specification TT-P-1561A, dated May 31, 1974, was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

Paragraph 2.1, under Federal Specifications, change "TT-P-143" to "PPP-P-1892".

Add paragraph 2.2 as follows:

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

- D 34 - Chemical Analysis of White Pigments.
- D 56 - Flash Point by Tag Closed Tester.
- D 480 - Aluminum Powder and Paste.
- D 521 - Chemical Analysis of Zinc Dust.
- D 562 - Consistency of Paints Using the Stormer Viscosimeter.
- D 717 - Magnesium Silicate Pigment.
- D 1208 - Common Properties of Certain Pigments.
- D 1475 - Density of Paint, Varnish, Lacquer, and Related Products.
- D 1542 - Rosin in Varnishes.
- D 2369 - Volatile Content of Paints.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

PAGE 3

Add paragraph 3.3.13 as follows:

3.3.13 Lead content. The paint shall contain not more than 0.06 percent lead by weight of nonvolatile when tested as specified in 4.3.15.

PAGE 5

Delete table IV in its entirety and substitute:

Item	TABLE IV. Index		Applicable Test Fed. Test Method Std. No. 141	Paragraph reference
	Requirement reference	ASTM		
Aluminum	Table I	D 480	----	----
Zinc dust	Table I	D 521	----	----
Zinc oxide	Table I	D 34	----	----
Extenders	Table I	D 717	----	----
Vinyl-Toluene Butadiene resin	Table II	----	----	3.2.2.1
Petroleum resin	Table II	----	----	3.2.2.1
Hydrocarbon resin	Table II	----	----	3.2.2.2
Rosin	Table II	D 1542 1/	----	----
Phenol	Table II	----	----	4.3.13
Flash point	Table III	D 56	----	----
Nonvolatile vehicle	Table III	----	4053	----

FSC 6010

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TABLE II. Index (con.)

Characteristic	Requirement Reference	Applicable Test		Paragraph Reference
		Fed. Test Method Std. No. 141	ASTM Method	
Storage stability	3.3.5	3021, 3022	----	4.3.5
Gas resistance	3.3.6	----	D 1643, Meth A	4.3.6
Draft resistance	3.3.7	----	D 1643, Sec 10-14	4.3.7
Water resistance	3.3.8	----	----	4.3.8
Odor	3.3.9	----	----	4.3.9
Lead	Table I	----	----	4.3.10

Paragraph 4.3.6. Line 1, delete "method 4161 of Fed. Test Method Std. No. 141" and substitute "ASTM Method D 1643, Method A".

Paragraph 4.3.6. Line 2, delete "Method 4162" and substitute "ASTM Method D 1643, Method B".

Paragraph 4.3.7. Line 1, delete "Method 4171 of Fed. Test Method Std. No. 141" and substitute "ASTM Method D 1643, Sec 10-14".

Add new paragraphs:

#### 4.3.10 Lead content.

4.3.10.1 Sample preparation. Using a 0.006-inch film applicator and a mechanical applicator plate, duplicate drawdowns for each sample of well-mixed paint shall be made on a standard paint penetration chart and dried for 24 hours. The drawdown shall be at least 10 inches long on the sealed portion of the penetration chart. The drawdown shall be cut into discs of appropriate size to fit the sample holder of a fluorescence X-ray spectrometer.

4.3.10.2 Procedure. Lead content shall be determined using an X-ray fluorescence spectrometer capable of determining lead content at a minimum level of 0.03 percent by weight of the total nonvolatiles. The settings for a wavelength dispersive fluorescence spectrometer shall be as follows: (1)

Element	Analytical Line	Angle	Crystal	Detection	Collimator	X-ray tube (Mo)
Pb	L	33.93	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Pb (backgd I)		33.00	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Pb (backgd II)		35.50	LiF(200)	Flow S.C.	Fine	60Kv 45Ma
Mo	K	20.11	LiF(200)	Flow S.C.	Fine	60Kv 45Ma

Pulse height selection shall be used in all measurements and counting time shall be 100 seconds. Place the sample disc in the wavelength dispersive unit. Measure the count rates of lead, lead background, and the Molybdenum Compton scattered background from the X-ray tube.

#### 4.3.10.3 Calculation.

$$R = \frac{I_{Pb} - \frac{I_{Pb} (3\% \text{ background I}) + I_{Pb} (3\% \text{ background II})}{2}}{I_{Mo}}$$

(1) Energy dispersive fluorescence spectrometers shall be set up according to the manufacturer's manual.

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where I equals gross intensity. These results shall be compared to those obtained with a 0.06 percent lead standard made up from the same type of paint sample and evaluated for compliance with table I.

Paragraph 4.4. Line 2: Change "TT-P-143" to "PPP-P-1892".

Paragraph 5.1.1. Line 3: Change "TT-P-143" to "PPP-P-1892".

Paragraph 5.1.2. Line 1: Change "TT-P-143" to "PPP-P-1892".

OCT. 2 1979

TT-P-1561A

May 31, 1974

SURROFUNG

Int. Fed. Spec. TT-P-001561 (HUD-11AA)

March 14, 1969

## FEDERAL SPECIFICATION

### PAINT, ZINC-ALUMINUM, RUST-INHIBITIVE (FOR RUSTY-GALVANIZED AND OTHER METAL SURFACES)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

#### 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers a ready-mixed paint, air drying type for use on rusted galvanized and other metallic structural surfaces. The paint can be applied by brush, spray, roller, or electrostatically (see 6.4).

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

##### Federal Specifications:

- QQ-H-25015 - Aluminum Alloy, Alclad 2024, Plate and Sheet.
- TT-P-143 - Paint, Varnish, Lacquer and Related Materials; Packaging, Packing and Marking Of.
- TT-P-320 - Pigment, Aluminum Powder and Paste for Paint.
- TT-P-460 - Pigment, Zinc Dust (Metallic Zinc-Powder) Dry.
- TT-P-463 - Pigment, Zinc Oxide, Dry and Paste-In-Oil.
- TT-T-291 - Thinner, Paint, Volatile Spirits, Petroleum Spirits.
- PPH-T-60 - Tape; Pressure Sensitive.

##### Federal Standards:

- Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling, and Testing.
- Fed. Std. No. 595 - Colors.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20540.)

(Single copies of this specification and other product specifications required by activities outside the Federal Government for billing purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

#### 3. REQUIREMENTS

3.1 Material. The ingredients used in the manufacture of the paint shall be of good commercial quality suitable for the purpose intended and the finish product shall comply to all the requirements specified herein. The thinner used in the process shall be a thinner conforming to TT-T-291, type II, grade A or a thinner conforming to Fed. Std. 595.

#### 3.2 Composition.

<sup>1</sup>Information on File 44 may be obtained from Los Angeles Air Pollution Control District, Los Angeles, California 90011.

EO 12812

TT-P-1501A

3.2.1 Pigments. The pigments shall be as specified in table I.

TABLE I. Pigment

Composition	Requirements	
	Minimum	Maximum
Aluminum (TT-P-320), percent by weight of pigment	51	---
Zinc dust (TT-P-460), percent by weight of pigment	16	---
Zinc oxide (TT-P-463, type I), percent by weight of pigment	--	7
Extenders, percent by weight of pigment	--	26

3.2.2 The non-volatile vehicle shall be a blend of resins (see Table II) together with driers, anti-gassing agents, plasticers, etc.

TABLE II. Non-volatile vehicle

Composition	Requirements	
	Minimum	Maximum
Vinyl-Toluene Butadiene resin, percent by weight	13	14
Petroleum resin, percent by weight	--	56
Hydrocarbon resin, percent by weight	--	33
Rosin	--	--
Phenol	--	--

3.2.2.1 Polyvinyl Toluene - butadiene copolymer resin. The resin shall have the following properties:

Form-----	Dry friable granules
Color of film-----	Clear (odorless)
Specific gravity, 25°/25°C.-----	1.03 $\pm$ 0.02
Index of refraction-----	1.57 $\pm$ 0.05
Softening point (Ring & Ball), °C.-----	45--51
Solution viscosity (33-1/3% resin in Xylene), #1 Ford	
Cup, seconds-----	160-195
Color (Gardner)-----	1

3.2.2.2 Hydrocarbon Resin. This material shall be a solid petroleum hydrocarbon resin produced by the polymerization of petroleum olefinic hydrocarbons and shall have the following properties:

Softening Point (Ring & Ball), C-----	100 $\pm$ 2
Color, Gardner-----	10 Max.
Specific Gravity-----	1.06 $\pm$ .05
Acid Number-----	1 Max.
Saponification Number-----	1 Max.
Flash Point C.O.C. °F.-----	425

3.2.2.3 The petroleum resin shall have a softening point of 250°  $\pm$  10°F. and a needle penetration of 43 at 77°F. when tested in accordance with Table IV.

3.2.3 The quantitative requirements of the paint shall be as specified in table III and as herein specified.

TABLE III. Quantitative Requirements

Characterization	Requirements	
	Minimum	Maximum
Flash point, degrees F-----	60	---
Nonvolatile vehicle, percent by weight of vehicle-----	35	---
Total solids, percent by weight of paint-----	53	---
Pigment, percent by weight of paint (Calculated)-----	26	---
Ash, percent of total paint-----	37	---
Consistency, Krebs-Storwer (KU)-----	75	85
Weight per gallon, pounds-----	9.00	---
Drying time:		
Set to touch, minutes-----	---	15
Dry hard, minutes-----	---	30
Dry through, hours-----	---	8
Flexibility, inch-----	1/8	---
Volatility, percent-----	---	0.5



### 3.3 Qualitative requirements.

3.3.1 Condition in container. The paint shall be capable of being readily mixed to a uniform and smooth consistency and shall show no livering, curdling, gelling, or other objectionable properties that would interfere with its application when tested in accordance with 4.3.1.

#### 3.3.2 Storage stability.

3.3.2.1 Partially full container. The well mixed paint in 3/4 full container shall show no skinning within 48 hours when tested as in 4.3.2.1.

3.3.2.2 Full container. When tested as in 4.3.2.2, the paint shall show no livering, curdling, hard-dry caking or tough gummy sediment. The stored paint shall redisperse readily to a homogeneous state. A certificate of compliance from the supplier that the paint stored for one year shall be useable.

3.3.3 Dilution stability. When thinned as specified in 4.3.3 the paint shall remain stable and uniform showing no separation nor gel formation.

3.3.4 Brushing properties. The paint as tested in 4.3.4 shall brush satisfactorily in all respects and shall dry to a smooth uniform film.

3.3.5 Spraying properties. The paint, tested as in 4.3.5 shall spray satisfactorily, in all respects and shall present a smooth finish.

3.3.6 Anchorage (adhesion). A film of the paint when tested as in 4.3.6 shall show no removal or otherwise loosening of the paint film beyond one sixteenth inch on either side of the score line.

3.3.7 Flexibility. When tested as described in 4.3.7, the paint shall show no evidence of cracking, chipping, or flaking.

3.3.8 Knife test. A film of the paint when tested as in 4.3.8 shall ribbon or curl from the metal on cutting and the cut shall show beveled edges.

3.3.9 Resistance to boiling water. A film of the paint, prepared and tested as in 4.3.9 shall show no wrinkling and no more than moderate whitening immediately after removal of the panel from the water. When examined 2 hours after removal, the film shall show no more than a slight dulling and a slight whitening.

3.3.10 Resistance to cold water. A film of the paint, prepared and tested as in 4.3.10 shall show no wrinkling and no more than slight whitening immediately after removal of the panel from the water. When examined 2 hours after removal, the film shall show no more than a slight dulling.

3.3.11 Accelerated weathering. A film of the paint prepared and tested as in 4.3.9 shall show no cracking, chipping, peeling or whitening and no more than a slight change in gloss after 300 hours exposure.

3.3.12 Salt spray resistance. When tested as specified in 4.3.10 there shall be no evidence of removal, flaking or loss of adhesion on the bare face of the panel except in the area 1/16" from either side of the scored line after 100 hours exposure.

### 4. QUALITY ASSURANCE REQUIREMENTS

4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to the prescribed requirements.

4.2 Sampling and inspection. Sampling and inspection shall be performed in accordance with method 101 of Fed. Test Method Std. No. 141.

4.3 Test procedures shall be conducted in accordance with Fed. Test Method No. 141 and as hereafter specified.

4.3.1 Condition in container. Test the paint condition of the paint in accordance with method 101 of Fed. Test Method Std. No. 141 for compliance with 3.3.1.

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4.3.2 Storage stability.

4.3.2.1 Partially full container. In accordance with method 3021 of Fed. Test Method Std. No. 141, determine skinning after 48 hours, except use a 3/4 filled 1/2 pint, multiple friction top can. Evaluate for compliance with 3.3.2.1.

4.3.2.2 Full container. Allow a full quart can of the paint undisturbed for twelve months in accordance with method 3022 of Fed. Test Method Std. No. 141. After test period evaluate for compliance with 3.3.2.2.

4.3.3 Dilution stability. Reduce 3 parts by volume of the package paint with 1 part by volume of thinner conforming to TT-T-291, type II, Grade A, then run the test according to method 4203 of Fed. Test Method Std. No. 141. Observe for compliance with 3.3.3.

4.3.4 Brushing properties. Reduce 9 parts by volume of the package paint with 1 part of volume thinner conforming to Federal Specification TT-T-291, type II, Grade A. Determine brushing properties in accordance with method 4321 of Federal Standard 141. Observe for compliance with 3.3.5.

4.3.5 Spraying properties. Reduce 4 parts by volume of the packaged paint with 1 part by volume of thinner conforming to Federal Specification TT-T-291, type II, Grade A. Spray a steel panel to dry film thickness between 0.0010 and 0.0012 inches and observe for spraying properties in accordance with method 4331 of Federal Standard 141 and observe for compliance with 3.3.6.

4.3.6 Anchorage (adhesion). Spray a film of the paint (see 4.3.5) to a dry film thickness of 0.0009 to 0.0011 on a solvent cleaned aluminum clad aluminum alloy panel (3-by-6-inch) conforming to QQ-A-250/5. Air dry in a horizontal position for 48 hours at room temperature. Score a line through to the metal across the width of the film using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with waterproof, pressure sensitive (3/4 inch wide) conforming to PFF-T-60, type IV. The tape shall be pressed in firm contact with the film and shall extend for approximately 1 inch on each side of the score line. With light pressure by the thumb rub the tape three times length wise. Grasp a free end of the tape and at a rapid speed strip it from the film by pulling the tape back upon itself at angle of 180°. Observe for compliance with 3.3.6.

4.3.7 Flexibility. Spray a coat of paint (see 4.3.5) to a maximum dry film thickness of 1 mil on a solvent cleaned panel prepared in accordance with method 2012 of Fed. Test Method Std. No. 141. Air dry for 18 hours at room temperature then bake for 2 hours at 105° ± 2°C. Cool for 1/2 hour, bend over 1/4-inch mandrel then examine for compliance with 3.3.7.

4.3.8 Knife test. Using a flat portion of the panel used in paragraph 4.3.7 perform the knife test in accordance with method 6104 of Fed. Test Method Std. No. 141. Observe for compliance with 3.3.8.

4.3.9 Resistance to boiling water. Prepare a 3 by 6 inch steel panel as 4.3.4. Air dry 2 hours under reference conditions and then immerse for 15 minutes in boiling water in accordance with method 6011 of Federal Standard 141. At the end of the test period remove the panel and check for compliance with 3.3.9.

4.3.10 Resistance to cold water. Prepare a panel as in 4.3.9. Coat all exposed unpainted metal surfaces with wax or a suitable protective coating. Then immerse in distilled water at 23° ± 1°C for 2 hours in accordance with method 6011 of Federal Standard 141. At the end of the test period remove and examine for compliance with 3.3.10.

4.3.11 Accelerated weathering. Place six 4 by 6 inch 20 gauge galvanized steel panels into a copper sulfate solution made by adding 24 ounces by weight of copper sulfate crystals (U.S.P., 0.0001 of sulfate acid resistant grade (Sp. Gr. at 60°F. 1.141-1.144)), and 4.8 ounces of sulfuric acid (U.S.P.) to one gallon of distilled water. Remove the six panels after one minute and immediately rinse with water. Solvent clean the panels as previously mentioned. Place 1/2 inch masking tape on one side of the panels with 1/8 inch in between. There should be five 1.8 inch gaps running parallel to the length of the panel. Completely cover the other exposed areas with masking tape. Place each panel in hydrochloric acid resistant grade (Sp. Gr. at 60°F. 1.144-1.148) for thirty minutes. Remove and immediately rinse with water. Place labeled taped panels in mixture of hydrochloric acid and nitric acid (Prepare acids by the following: F. W. Schlenk, Sp. Gr. at 60°F. 1.14-1.144-1.148; F. W. Schlenk, Sp. Gr. at 60°F. 1.144-1.148) in the ratio of 53 grams of nitric acid to 100 grams of hydrochloric acid. Immerse in mixture for five minutes. Remove and immediately rinse with water. After rinsing with water, place labeled panels in distilled water that has been adjusted to a pH of 1.3 with the use of hydrochloric acid. Allow panels to remain in water until the panels can be placed on a scale of 1.0 to 1.5 grams of the

glass cylinder. Only three-quarters of the panel should be immersed in the acid solution. Leave the panels in the solution for twenty hours, remove, rinse and condition at room temperature for twenty-four hours so that the corrosion will develop further. Save four panels for use. Spray a coat of the paint on two of the panels to a dry film thickness of  $2.0 \pm 0.2$  mils and air dry for 96 hours. Subject the coated panels to 300 hours of accelerated weathering in accordance with Method 6151 of Federal Test Method Std. 141a. Examine for compliance with 3.3.11.

4.3.12 Salt spray. Spray a coat of the paint on the face of duplicate 4 x 6 inch galvanized steel panels to a dry film thickness of  $2.0 \pm 0.2$  mils. Coat the backs of panels with paraffin wax. Using a sharp knife, cut a large X through the paint film with each extremity of the X to be between  $1/4$  and  $1/2$  inch from the corners of the panel. Expose the panels supported at an angle of  $30^\circ$  from the vertical and parallel to the principle flow of the fog spray and proceed to test in accordance with method 6061 of Federal Test Method Standard No. 141a for 200 hours. Examine for compliance with 3.3.12.

4.3.13 Phenol-qualitative. Place in a disposable aluminum pan a sample of the coating compound representing 0.5 to 1.0 gram of non-volatile matter and dry for three hours in an oven at  $105^\circ\text{C}$ . Tear off the sides of the pan and fold back the remainder. Immerse under 5 to 10 milliliters of chloroform in a test tube for an hour or longer. Then decant the chloroform into another test tube and add to the chloroform an equal volume of 5 percent aqueous sodium hydroxide solution. Immediately after an emulsion is formed by agitation, add a few crystals of 2, 6 dibromoquinone chlorimide. Allow the test tube to stand and observe for the familiar blue streaks which indicate phenol.

4.3.14 Inspection of preparation for delivery. The packaging, packing, and marking shall be examined and tested to determine compliance with section 5 of this specification.

TABLE IV. Index

Item	Requirement reference	Applicable Test	
		Fed. Test Method Std. No. 141 and ASTM	Paragraph reference
Aluminum	Table I	7233	-----
Zinc dust	Table I	7221	-----
Zinc oxide	Table I	7091	-----
Extenders	Table I	7251	-----
Vinyl-Toluene Butadiene resin	Table II	-----	3.2.2.1
Petroleum resin	Table II	-----	3.2.2.3
Hydrocarbon resin	Table II	-----	3.2.2.2
Rosin	Table II	5031	-----
Phenol	Table II	-----	4.3.13
Flash point	Table III	4291	-----
Non-volatile vehicle	Table III	4053	-----
Total solids	Table III	4041	-----
Pigment	Table III	4021	-----
Ash	Table III	5251	-----
Consistency	Table III	4031	-----
Weight per gallon	Table III	4134	-----
Drying time	Table III	4061	-----
Flexibility	Table III	6021	-----
Condition in container	3.3.1	3011	4.3.1
Storage stability	3.3.2	3021	4.3.2
Dilution stability	3.3.3	-----	4.3.3
Brushing property	3.3.4	-----	4.3.4
Spraying property	3.3.5	-----	4.3.5
Anchorage	3.3.6	-----	4.3.6
Flexibility	3.3.7	-----	4.3.7
Knife test	3.3.8	-----	4.3.8
Resistance to boiling water	3.3.9	-----	4.3.9
Resistance to cold water	3.3.10	-----	4.3.10
Accelerated weathering	3.3.11	-----	4.3.11
Salt spray	3.3.12	-----	4.3.12

#### 5. PREPARATION FOR DELIVERY

c. NOTES:

6.2 Ordering data. Procurement documents should specify the following:

- 6.4 Electrostatic application instructions shall be furnished by the supplier.

HUD - HHS  
GSA - HHS

USA - F33



BRUCE BABBITT  
Governor

WILLIAM A. ORDWAY  
Director

# ARIZONA DEPARTMENT OF TRANSPORTATION

## HIGHWAYS DIVISION

206 South Seventeenth Avenue Phoenix, Arizona 85007

MATERIALS SERVICES  
1745 West Madison Street  
Phoenix, Arizona 85007

OSCAR T. LYON, JR., P.E.  
Assistant Director  
and State Engineer

October 24, 1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

In response to your request for specifications for zinc-rich paints or primers, I have attached a copy of our standard specification dealing with paint. Paint Number 15 (Zinc) is a zinc-dust zinc-oxide primer, however, we do not use it very often. Most of our structural steel is protected with either red or blue lead and then a finish coat of paint.

I hope this information is useful to you. If you have need of any further information, feel free to contact me.

Sincerely yours,

G. J. Allen, P.E.  
Engineer of Materials

DAF:ng  
Attachment



# SECTION 717, 718

## SECTION 717 - WOOD PRESERVATIVE TREATMENT

**717(A)** Structural timber and lumber, timber piling, posts and miscellaneous lumber, when required to be treated, shall be pressure treated in accordance with the requirements of AASHTO M 133 for Preservative Quality and Preservative Treatment Processes and Results.

## SECTION 718 - PAINT

### General:

The paint mixed in accordance with the formulas hereinafter given, shall be composed of materials or ingredients conforming to the following specifications:

### 718(B) Vehicles:

Raw Linseed Oil ~~AASHTO M 125~~ ASTM D 234  
Boiled Linseed Oil ~~AASHTO M 126~~ ASTM D 260  
Water-Resistant Spar Varnish Navy Department Specification 52V20  
Alkyd Resin TT-R-266a Type I, Class B  
Alkyd Resin TT-R-266a Type II  
Alkyd Resin TT-R-266a Type III  
Driers ASTM D 600, Class A or Class B, as applicable

### Thinners:

Xylene TT-X-916, Grade A  
Turpentine (shall be used in paints for timber) ~~AASHTO M 127~~ Gum Spirits ASTM D 13

~~AASHTO M 128~~ ASTM D 235

### Pigments:

Petroleum Spirits (Mineral Spirits)  
Carbonblack TT-P-343 Form 1, Class B  
Lampblack ASTM D 209  
Red Lead ~~AASHTO M 71~~ ASTM D 83  
Blue Lead, Basic Sulfate ASTM D 405  
Titanium Dioxide, Non-extended ASTM D 476, Type II, Class II

# SECTION 716

Centrifuged lime and sufficient water to provide a slurry having the consistency considered as an adequate coating as required by any cement.

Cement and water shall conform to the requirements of American Portland Cement and 7 (b) respectively. The cement shall conform to the grading requirements of ASTM C 150. The water shall conform to the requirements of ASTM C 150, Type N.

## 716(C) Flexible Plastic Gaskets:

The gasket shall be produced from blends of refined hydrocarbon resins and plasticizing compounds in accordance with the following: The gasket shall contain no fillers, pigments, or other materials which may cause deterioration of the gasket or cause it to lose its cohesive strength and adhesion. The gasket shall be extruded in the form of suitable cross section and shall be 1/2 in. to 5/8 in. thick. The gasket shall be protected by a suitable non-abrasive two-piece wrapper so designed as to prevent the gasket from being damaged, longitudinally, without disturbing the gasket.

The composition and properties of the plastic gasket shall conform to the following:

Requirement	ASTM Test Method	Min.	Max.
Minimum Petroleum Plastic Content, %	D4	50	70
Moisture, %	T111	30	50
General Properties, millimeter	D217		
32 degrees F., 30 grams, 60 sec.		75	
70 degrees F., 150 grams, 5 sec.		150	
100 degrees F., 50 grams, 5 sec.		150	
Softening Point, degrees F.	D36	320	
Shrinkage, 77 degrees F.	D71	1.20	1.35
Shrinkage, 77 degrees F., cm.	D113	5	
Shrinkage, 77 degrees F., Open Cup, mm.	D92	600	
Shrinkage, 77 degrees F., Open Cup, mm.	D92	625	
Shrinkage, 77 degrees F., Open Cup, mm.	D6	2	

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ARTECH CORP FALLS CHURCH VA  
REVIEW OF SPECIFICATIONS FOR ZINC-RICH PAINTS. (U)

F/G 11/3

SEP 79 F ORDWAY, M J HAMMELL

N00600-76-D-0511

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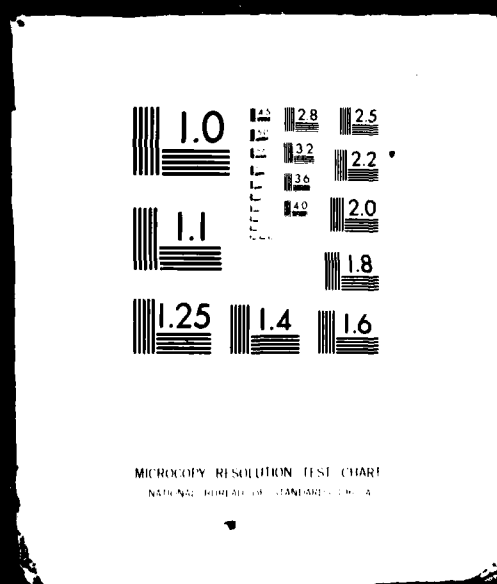
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9 OF 9

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SECTION 718

shall be added the remainder of the vehicle to make paint conforming to the required formula as herein specified.

The paint shall be furnished in substantial sealed containers, plainly marked with lot number and the name and address of the manufacturer. The container shall have a formula label.

Paint which has hardened and thickened in the container such that it cannot be readily broken up to a smooth uniform paint of good brushing consistency shall not be used.

All paints, except Paint No. 10 (Aluminum), shall be shipped ready for use.

All materials used in mixed paints shall conform to the requirements as herein specified. The paint shall be made to satisfactory workable consistency conforming to one of the following formulas for paint as required on the plans or in the special provisions. All percentages shown are by weight.

Any of the following paints which are too thick to have a satisfactory workable consistency shall be thinned with a suitable thinner from the group of thinners herein specified. In no case shall gasoline be used as a thinner.

Fineness of grind for enamel shall conform to Hegman 7 minimum.

When Paint No. 1 is specified, it may be Paint No. 1-A or Paint No. 1-B. Paint No. 1-D shall be used only when specifically designated.

Paint Number 1-A (Red Lead-Linseed Oil):

Pigment ..... 77% to 79%  
Vehicle ..... 21% to 23%

The pigment shall consist of:  
Red Lead ..... 100%

The vehicle shall consist of:

Linseed Oil (raw) ..... 90%  
Thinner ..... 5%  
Drier ..... 5%

SECTION 718

Titanium Dioxide, Extended (Titanium Calcium Rutile) ..... ASTM D 476

Titanium Dioxide ..... TT-P-422, Type III, Class A

White Lead Basic Carbonate ..... ~~ASTM D 478~~ ~~ASTM D 79~~ ~~ASTM D 81~~

Zinc Yellow (Zinc Chromate) ..... ASTM D 478, Type II

Zinc Oxide ..... ~~ASTM D 478~~ ~~ASTM D 79~~

Iron Blue ..... TT-P-385

Iron Oxide, Yellow ..... TT-P-458A

Iron Oxide, Orange ..... ASTM D 84

Hansa Yellow G ..... MIL-H-10130

Organic Green Gold ..... DuPont YT 562-D or equal, specific gravity shall be 1.61

Chromium Oxide, Green Graphite ..... TT-P-347

Graphite shall be natural amorphous material (American product) which shall contain not less than 35 percent nor more than 45 percent graphite carbon. The remainder shall be insoluble siliceous material containing a total of not more than 5 percent calcium and magnesium carbonate and sulfate. The pigment shall be ground to such a fineness that not less than 97 percent shall pass a No. 325 sieve. The graphite paste shall be made by grinding the pigment in pure raw linseed oil in the following proportions:

Amorphous Graphite ..... 68.0%  
Linseed Oil ..... 32.0%

718(D) Inert Materials:

Diatomaceous Silica ..... ASTM D 604, Type A  
Magnesium Silicate ..... ASTM D 605

718(F) Mixed Paints:

All mixed paints shall, in general, be machine-mixed and shall consist of the pigment of the required fineness and composition, ground to the desired paste consistency in pure raw or boiled linseed oil, to which

## SECTION 718

## Paint Number 1-B (Red Lead-Alkyd Resin):

Pigment ..... 69% to 71%  
 Vehicle ..... 29% to 31%

The pigment shall consist of:

Red Lead ..... 87% Minimum  
 Magnesium Silicate ..... 9% Maximum  
 Diatomaceous Silica ..... 4% Maximum

The vehicle shall consist of:

Alkyd Resin (Type II) ..... 57.3%  
 Linseed Oil (raw) ..... 7.8%  
 Petroleum Spirits and Drier ..... 34.9%

The finished paint shall weigh a minimum of 19.7 pounds per gallon, have a viscosity of 65-75 KU, set to touch in two hours and dry for recoat in eight hours.

## Paint Number 1-D (Zinc Chromate):

Pigment ..... 45% to 47%  
 Vehicle ..... 53% to 55%

The pigment shall consist of:

Zinc Chromate ..... 55% Minimum  
 Titanium Dioxide (Extended) ..... 15% Minimum  
 Magnesium Silicate ..... 30% Maximum

The vehicle shall consist of:

Water-Resistant Spar Varnish ..... 33%  
 Alkyd Resin (Type II) ..... 28%  
 Drier and Thinner ..... 39%

The finished paint shall weigh a minimum of 11.0 pounds per gallon, have a viscosity of 70-75 KU, set to touch in two hours and dry for recoat in eight hours.

## Paint Number 2 (Light Brown):

Pigment ..... 76% to 78%  
 Vehicle ..... 22% to 24%

The pigment shall consist of:

Red Lead ..... 99%  
 Lampblack ..... 1%

The vehicle shall consist of:

Linseed Oil (raw) ..... 90%  
 Thinner ..... 5%  
 Drier ..... 5%

When used as second coat to be covered by a third coat, this paint may be thinned by the addition of one-half pint of thinner to each gallon of mixed paint.

## SECTION 718

## Paint Number 3 (Blue Lead-Alkyd Resin):

Pigment ..... 55% to 60%  
 Vehicle ..... 40% to 45%

The pigment shall consist of:

Blue Lead ..... 92% to 94%  
 Inerts ..... 6% to 8%

The vehicle shall consist of:

Alkyd Resin (Type II) ..... 69%  
 Linseed Oil (raw) ..... 6%  
 Petroleum Spirits and Drier ..... 25%

The finished paint shall weigh a minimum of 14.7 pounds per gallon, have a viscosity of 80-90 KU, set to touch in two hours and dry for recoat in eight hours.

When used as a second coat to be covered by a third coat, this paint may be thinned by the addition of one-half pint of thinner to each gallon of mixed paint.

## Paint Number 4 (Dull Black):

Pigment ..... 44% to 46%  
 Vehicle ..... 54% to 56%

The pigment shall consist of:

Amorphous Graphite ..... 100%

The vehicle shall consist of:

Linseed Oil (raw) ..... 85%  
 Thinner ..... 7.5%  
 Drier ..... 7.5%

## Paint Number 5 (Jet Black):

This paint shall be composed of a base containing genuine Gilsonite asphalt (99.5% pure bitumen) and pure linseed varnish and drier. The base shall be prepared by a special heat treatment and combined with petroleum spirits to a paint consistency.

This paint shall be equal in all respects to the product known as Valdura Gilsonite (black).

## Paint Number 6 (Black) (for timber only):

Pigment ..... 25% to 30%  
 Vehicle ..... 70% to 75%

The pigment shall consist of:

Lampblack ..... 35% Minimum  
 Inerts ..... 65% Maximum

## SECTION 718

The vehicle shall consist of:  
 Linseed Oil (raw) ..... 85%  
 Thinner (turpentine only) ..... 10%  
 Drier ..... 5%

## Paint Number 7 (White) (for timber primer only):

Use Paint No. 8, thinned by the addition of one pint of turpentine to each gallon of mixed paint.

## Paint Number 8 (White):

Pigment ..... 66% to 68%  
 Vehicle ..... 32% to 34%

The pigment shall consist of:

White Lead ..... 43% to 45%  
 Titanium Dioxide (Extended) ..... 15% to 20%  
 Zinc Oxide ..... 20% to 22%  
 Inerts ..... 20% Maximum

The vehicle shall consist of:

Linseed Oil (raw) ..... 90%  
 Thinner (turpentine only for paint used on timber) ..... 5%  
 Drier ..... 5%

When used as a second coat to be covered by a third coat, this paint may be thinned by the addition of one-half pint of thinner to each gallon of mixed paint.

## Paint Number 9 (Light Gray):

This paint shall be the same as Paint No. 8, except that the pigment shall include 0.25 percent of lamp-black as a tint.

## Paint Number 10 (Aluminum):

This paint shall conform to the specifications for Aluminum Paint (aluminum pigment paste-mixing varnish), AASHO M. 69.

The quantity of this paint mixed on any one day shall be limited to the quantity to be used during that day.

## Paint Number 11 (White Enamel):

Pigment ..... 30% to 32%  
 Vehicle ..... 68% to 70%

## SECTION 718

The pigment shall consist of:

Titanium Dioxide (Unextended) 76% to 78%  
 Zinc Oxide ..... 22% to 24%

The vehicle shall consist of:

Alkyd Resin (Type I, Class B) ..... 75%  
 Thinner and Drier ..... 25%

The finished paint shall weigh a minimum of 9.9 pounds per gallon and have a viscosity of 70-80 KU.

## Paint Number 12 (Yellow Enamel):

Pigment ..... 13% Minimum  
 Vehicle ..... 87% Maximum

The pigment shall consist of:

Hansa, Yellow G ..... 44% Maximum  
 Titanium Dioxide ..... 39% Minimum  
 Organic Green Gold ..... 17% Minimum

The vehicle shall consist of:

Alkyd Resin (Type III) ..... 87% Minimum  
 Xylene ..... 11% Maximum  
 Driers and Antiskinning Agents 2% Maximum

The finished paint shall weigh a minimum of 8.4 pounds per gallon, have a viscosity of 75-80 KU, set to touch in two hours and dry for recoat in eight hours, tint to match color chip as furnished.

## Paint Number 13 (Dark Olive Green Enamel):

Pigment ..... 11% Minimum  
 Vehicle ..... 89% Maximum

The pigment shall consist of:

Iron Oxide (Orange Shade) ..... 94% Maximum  
 Carbon Black ..... 3% Minimum  
 Iron Blue ..... 3% Minimum

The vehicle shall consist of:

Alkyd Resin (Type III) ..... 75% Minimum  
 Drier and Thinners ..... 25% Maximum

The finished paint shall weigh a minimum of 8.4 pounds per gallon, have a viscosity of 65-75 KU, set to touch in two hours and dry for recoat in eight hours, tint to match color chip as furnished.

## Paint Number 14 (Buff Enamel):

Pigment ..... 30% Maximum  
 Vehicle ..... 70% Minimum

# SECTION 719

The pigment shall consist of:  
 Iron Oxide (Yellow) ..... 27% Maximum  
 Titanium Dioxide (Type III, Class A) ..... 73% Minimum  
 Soya Lecithin ..... 3 to 5 pounds per 100 gallons  
 The vehicle shall consist of:  
 Alkyd Resin (Type I, Class B) .. 71% Minimum  
 Petroleum Spirits, Driers and Antiskinning Agents ..... 29% Maximum  
 The finished paint shall weigh a minimum of 9.5 pounds per gallon, have a viscosity of 62-70 KU, set to touch in two hours and dry for recoat in eight hours, tint to match color chip as furnished.

## Paint Number 15 (Zinc):

This paint shall be a zinc-dust zinc-oxide primer conforming to the requirements of Federal Specification TT-P-641.

## Paint Number 16 (Industrial Synthetic Enamel):

This paint shall conform to the requirements of Federal Specification TT-E-489.

## Paint Number 17 (Green Enamel):

Pigment ..... 30% Maximum  
 Vehicle ..... 70% Minimum

The pigment shall consist of:

Chromium Oxide, Green ..... 34% Maximum  
 Titanium Dioxide (Type III, Class A) ..... 66% Minimum

The vehicle shall consist of:

Alkyd Resin (Type I, Class B) .. 71% Minimum  
 Petroleum Spirits, Driers and Antiskinning Agents ..... 29% Maximum

The finished paint shall weigh a minimum of 9.6 pounds per gallon, have a viscosity of 65-70 KU, set to touch in two hours and dry for recoat in eight hours, tint to match color chip as furnished.

# SECTION 719 - DAMPPROOFING AND WATERPROOFING

## 719(A) Asphaltic Primer:

Asphaltic primer shall be composed of asphalt, as specified below, and a solvent. The solvent shall be a

TABLE 719 - 1

Requirement	AASHTO Test Method	Minimum	Maximum
Solfining Point (Ring-and-Ball Method), degrees F.	T 53	140	170
Penetration at 115 degrees F., 50g., 5 sec. 77 degrees F., 100g., 5 sec. 32 degrees F., 200g., 60 sec.	T 49	22	40
Flash Point (Tag, Open Cup), degrees F.	T 79	400	
Loss on Heating at 325 degrees F., 50g., 5 hours, percent	T 47		0.5
Penetration at 77 degrees F., 100g., 5 sec. of residue after heating at 325 degrees F., as compared with penetration of asphalt before heating, percent	T 49	60	
Ductility at 77 degrees F., cm.	T 51	5	
Solubility in carbon disulphide, percent	T 44	99	

#### SECTION 719

The pigment shall consist of:  
Iron Oxide (Yellow) ..... 27% Maximum

Titanium Dioxide (Type III, Class A) ..... 73% Minimum

Soya Lecithin ..... 3 to 5 pounds per 100 gallons

The vehicle shall consist of:  
Alkyd Resin (Type I, Class B) .. 71% Minimum

Petroleum Spirits, Driers and Antiskinning Agents ..... 29% Maximum

The finished paint shall weigh a minimum of 9.5 pounds per gallon, have a viscosity of 62-70 KU, set to touch in two hours and dry for recoat in eight hours, tint to match color chip as furnished.

#### Paint Number 15 (Zinc):

This paint shall be a zinc-dust zinc-oxide primer conforming to the requirements of Federal Specification TT-P-641.

#### Paint Number 16 (Industrial Synthetic Enamel):

This paint shall conform to the requirements of Federal Specification TT-E-489.

#### Paint Number 17 (Green Enamel):

Pigment ..... 30% Maximum  
Vehicle ..... 70% Minimum

The pigment shall consist of:

Chromium Oxide, Green ..... 34% Maximum

Titanium Dioxide (Type III, Class A) ..... 66% Minimum

The vehicle shall consist of:

Alkyd Resin (Type I, Class B) .. 71% Minimum

Petroleum Spirits, Driers and Antiskinning Agents ..... 29% Maximum

The finished paint shall weigh a minimum of 9.6 pounds per gallon, have a viscosity of 65-70 KU, set to touch in two hours and dry for recoat in eight hours, tint to match color chip as furnished.

#### SECTION 719 - DAMPROOFING AND WATERPROOFING

#### 719(A) Asphaltic Primer:

Asphaltic primer shall be composed of asphalt, as specified below, and a solvent. The solvent shall be a

Requirement	AASHTO Test Method	Minimum	Maximum
Softening Point (Ring-and-Ball Method), degrees F.	T 53	140	170
Penetration at 115 degrees F., 50g., 5 sec. 77 degrees F., 100g., 5 sec. 32 degrees F., 200g., 60 sec.	T 49	22	40
Flash Point (Tag, Open Cup), degrees F.	T 79	400	
Loss on Heating at 325 degrees F., 50g., 5 hours, percent	T 47		0.5
Penetration at 77 degrees F., 100g., 5 sec. of residu after heating at 325 degrees F., before heating, percent	T 49	60	
Ductility at 77 degrees F., cm.	T 51	5	
Solubility in carbon disulphide, percent	T 44	99	

TABLE 719 - 1

GOVERNMENT OF THE DISTRICT OF COLUMBIA  
DEPARTMENT OF TRANSPORTATION

ADDRESS REPLY TO  
BUREAU OF DESIGN, ENGINEERING & RESEARCH  
813 G STREET, N.W.  
WASHINGTON, D.C. 20001



October 26, 1979

OCT. 31 REC'D

Dr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, VA 22042

OCT. 31 1979

Dear Dr. Ordway:

In response to your inquiry concerning zinc-rich paints or primers, please be advised that these materials are not specified by this department.

Very truly yours,

A handwritten signature in cursive script, reading "Luther G. Martin, Jr.".

LUTHER G. MARTIN, JR.  
Engineer of Materials and Research

Kentucky Specification received from Mr. John E. McChord,

## SPECIAL NOTE FOR INORGANIC ZINC RICH PRIMER

### I. DESCRIPTION

This Special Note covers requirements for an inorganic zinc silicate paint, to be used as a prime coat on structural steel.

### II. REQUIREMENTS

A. General. The inorganic zinc rich primer shall be a 2-component self curing type which cures without the use of a separate curing solution. This paint shall be furnished by an established manufacturer of zinc silicate paint.

#### B. Composition.

1. Zinc Dust -- The zinc component shall be a finely divided zinc powder containing, by weight, a minimum of 95 percent metallic zinc and a minimum of 96 percent total zinc. All other fillers contained in the zinc component shall be inert substances. No toning pigment should be included. The average particle size shall be 4-9 microns.

2. Base Component -- The base component shall consist primarily of a partially hydrolyzed ethyl or alkyl silicate in an appropriate alcohol solvent.

#### 3. Properties of Mixed Paint --

(a) The total zinc portion shall be at least 85 percent by weight of the total solids of the dried coating.

(b) The total solids, when heated at 105 degrees C for three hours shall be no less than 70 percent by weight.

(c) The paint shall tolerate up to one percent water contamination by weight without gelation within 5 minutes.

(d) The usable pot life of the mixed paint shall be no less than 8 hours at 77 degrees F. There shall be no hard settling which cannot be easily redispersed during this period.

(e) Weight per gallon, pounds at 77 degrees F: 17.0 minimum.

C. Color. The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast cleaned metal surfaces and with the finish coat.

D. Packaging. Inorganic zinc paint shall be packaged in two-component containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle will yield five gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint and the lot number. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.



E. Approval. Each shipment of the inorganic zinc rich primer shall be accompanied by notarized test reports from an independent laboratory showing actual test results conforming to all requirements herein. The test reports shall show the manufacturer's name, brand name of paint, lot tested, and date of manufacture.

Each shipment shall also be accompanied by a certification from the manufacturer that the material furnished is formulated the same as the material upon which the testing was performed.

The Bureau will sample each shipment in accordance with the Bureau's "Manual of Field Sampling and Testing Practices", and may perform whatever testing deemed necessary. Material will be rejected at any time that actual tests show that the material does not conform to the requirements herein.

F. Application. The inorganic zinc primer shall be applied in strict accordance with the manufacturer's written instructions. Copies of the manufacturer's application instructions shall be furnished to the Engineer before painting is begun.

The Contractor shall furnish a representative of the zinc paint manufacturer when application begins, to observe the initial application and advise the Engineer and the Contractor as to proper application techniques, and when proper results are being obtained.

Dry film thickness of the prime coat shall be 3.0 mils  $\pm$  0.5 mil.

The zinc primer shall not be covered by an additional coat of paint until at least 72 hours have elapsed, or such other time as may be recommended in writing by the paint manufacturer.

May 16, 1979

State of Louisiana  
Department of Transportation and Development



EDWIN EDWARDS  
GOVERNOR

GEORGE A. FISCHER  
SECRETARY

P.O. Box 44245 Capitol Station Baton Rouge, Louisiana 70804

November 15, 1979

Artech Corporation  
2901 Telstar Court  
Falls Church, Virginia 22042

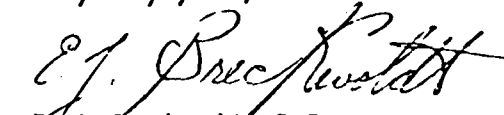
Attention: Mr. Fred Ordway  
Executive Vice President

Dear Mr. Ordway:

In reply to your letter of September 19, 1979, we are enclosing a copy of our latest specification for organic zinc primer, vinyl wash intermediate primer and vinyl leafing aluminum top coat system. Note that some of the very important parts of the specification have been emphasized in yellow.

We are happy to be of assistance in your program.

Very truly yours,

  
E. J. Breckwoldt, P.E.  
Materials & Research Engineer

EJB:JAP:dm  
Enclosure

## SPECIFICATIONS FOR THREE COAT ORGANIC ZINC SYSTEM

## 1. Organic Zinc Rich Primer

Generic Type Vehicle - Epoxy Polyamide (Catalyzed)

Base CompositionPigments: (80% of Total Base, min.)

## Parts by weight of pigment

Zinc Dust TT-P-460, Type I	98% min.
Thixotropes and Tinting Pigments	2% max.
Purity of Zinc Dust	95%

Vehicle: (20% of Total Base, max.)

## Parts by weight of vehicle

Epoxy Resin (Epoxy Equ. 450-550)	18-26%
Film forming additives	1.1% max.
Solvent blend	77% max.

Ethylene Glycol Monoethyl Ether - 10% max. of Solvent Blend

Sp. Gravity (3.10 min.)

Solids (wt.) (80% min.)

NOTE: Material must not settle to the point that it cannot be stirred back in easily.  
Material must not show any signs of gassing.

Curing Agent

The curing agent must be a clear non-pigmented solution consisting of the following:

Property	% by weight of Curing Agent
Polyamide (amine value 200-250)	25-29
Solvent mixture:	71-75
Cellasolve (max.)	25% of solvent
Xylene (min.)	36% of solvent

Sp. Gravity: 0.9

Solids (wt.): 25-29%

## Specifications for Three Coat Organic Zinc System

Mixed PrimerPhysical Property:Value:

% Solids (by wt.) min.	80
% Volatile (by wt.) max.	20
Wt./gallon, lbs., min.	21.0
Dry to touch, minutes, max.	30.0
Dry through, hours, max.	8

Thinning - shall be according to manufacturer's recommendations, not to exceed 12%.

## 2. Vinyl Wash Primer

The vinyl wash primer shall conform to Federal military specifications MIL-P-15328 B with this requirement: In Table I, Formula No. 117, use the Ethyl alcohol as described in Note 4.

## 3. Vinyl Aluminum Topcoat

	Percent of Paint
Vinyl Resin (VAGH & VMCH equal parts) % min.	15.00
Epoxy resin (Epon 828), % max.	0.07
Diethylphthalate (DOP), % max.	3.83
Aluminum powder, lbs.	6.52
(TT-P 320 Type I Class 2 - leafing), max.	
N Butyl Acetate, %	55-65
Toluene, %	10-20

Physical Properties:

% Solids (by wt.), min.	24
% Volatile (by wt.), max.	76
Wt./gallon, lbs.	7.8 - 8.5
Dry touch, minutes, max.	30
Dry through, hours	3 - 4
Viscosity	60 - 100
Storage, yrs., min.	1

Thinning - shall be in accordance with manufacturer's recommendations, not to exceed 10%.

## Specifications for Three Coat Organic Zinc System

The minimum dry film thickness of individual coatings shall be as follows:

1. Organic zinc primer - 3.0 mils minimum above the high points in the anchor pattern.
2. Vinyl wash primer - 0.3-0.7 mils
3. Vinyl aluminum topcoat - 3 mils minimum

The vinyl wash primer shall not be applied more than 72 hours before application of the finishing coat.

*P-10 Very Close not exact*

MIL-P-15328D  
5 May 1961  
SUPERSEDING  
MIL-C-15328A  
17 March 1952

MILITARY SPECIFICATION  
PRIMER, PRETREATMENT  
(FORMULA NO. 117 FOR METALS)

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 This specification covers primer pretreatment; coating for use on clean metal surfaces of all types as a treatment prior to application of the coating system. The purpose of the material is to increase the adhesion of the coating system. It is not intended as a permanent protective coating in itself.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified:

SPECIFICATIONS

FEDERAL

- O-E-760 - Ethyl Alcohol (Ethanol; Denatured Alcohol and Proprietary Solvent).
- O-P-313 - Phosphoric Acid; Technical Grade.
- RR-S-366 - Sieves; Standard, Testing.
- TT-B-846 - Butyl Alcohol, Normal (for Use in Organic Coatings).
- TT-L-70 - Lampblack, Dry (Paint-Pigment).
- PPP-B-535 - Boxes, Wood, Wirebound.
- PPP-B-591 - Boxes, Fiberboard, Wood-Cleated.
- PPP-B-591 - Boxes, Wood, Cleated-Plywood.
- PPP-B-521 - Boxes, Wood, Nailed and Lock-Corner.
- PPP-B-536 - Box, Fiberboard.
- PPP-C-95 - Cans, Metal, 23 Gage and Lighter.
- PPP-P-704 - Pails, Shipping, Steel.

MILITARY

- MIL-B-10377 - Boxes: Wood-Cleated, Veneer, Paper Overlaid.
- MIL-L-10547 - Liners, Case, Waterproof.
- MIL-M-15173 - Magnesium Silicate (Flatting Extender Pigment).
- MIL-L-10163 - Labels for Hazardous Industrial Chemicals and Materials.

STANDARDS

FEDERAL

- FED-STD-141 - Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling, and Testing.

MILITARY

- MIL-STD-129 - Marking of Shipments.
- MIL-STD-147 - Palletized Unit Loads - 40 in. x 48 in. 4-Way Partial and 4-Way Pallets.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

CODE OF FEDERAL REGULATIONS:

- 49 CFR 71-78 - Interstate Commerce Commission Rules and Regulations for Transportation of Explosives and other Dangerous Articles.

(Applications for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

OFFICIAL CLASSIFICATION COMMITTEE  
Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York 16, N.Y.)

NATIONAL BUREAU OF STANDARDS  
Certificate of Analysis.

# MIL-P-15328D

(Application for copies should be addressed to the National Bureau of Standards, Washington 25, D.C.)

## 3. REQUIREMENTS

### 3.1 Formula.

3.1.1 The primer shall consist of ingredients conforming to the applicable specifications in the

proportions shown in table I. The formula of the base is given slightly in excess of 80 gallons to allow for normal manufacturing loss.

3.1.2 The formula shown in table I is designated Navy Standard formula No. 117. Wherever formula No. 117 is specified, the primer shall conform to this specification.

Table I - Formula No. 117

	Pounds per 100 gallons of mixed material	Gallons per 100 gallons of mixed material
Ingredients of resin component (80 gallons)		
Polyvinyl-butylal resin (Note 1)	56	6.10
Zinc chromate (insoluble type) (Note 2)	54	1.78
Magnesium-silicate (Type A or B of Specification MIL-M-15173)	8	0.34
Lampblack (Specification TT-L-70)	0.6	0.02
Butyl alcohol, normal (Spec. TT-B-846)	125	18.48
Isopropyl alcohol, 99 percent (Notes 3 & 4)	353	53.80
Water	15	1.80
Ingredients of acid component (20 gallons)		
Phosphoric acid (Class A of Spec. O-P-313)	28	2.0
Water	25	3.0
Isopropyl alcohol, 99 percent (Notes 3 & 4)	99	15.0

### NOTES:

1. The resin shall be a polyvinyl partial butylal resin containing only polyvinyl butylal, polyvinyl alcohol, and polyvinyl acetate in the molecule. The resin shall contain 18.0 to 20.0 percent vinyl alcohol, and not more than 1.0 percent of vinyl acetate. A 6 percent solution of the resin in methanol shall have a viscosity of 12 to 18 centipoises at 20°C. The specific gravity of the resin shall be 1.05 to 1.15.
2. The zinc chromate shall be of an insoluble type, showing an analysis of 15 to 19 percent  $\text{CrO}_3$ , and 67 to 72 percent  $\text{ZnO}$ , and not more than 1 percent water soluble salts.
3. Isopropyl alcohol, 99 percent shall have a specific gravity of 0.785 to 0.790 at 20/20°C. and a distillation range not greater than 1.5°C. and this range shall include 82.3°C.
4. Ethyl alcohol conforming to Grade III of Specification O-E-760 may be substituted for isopropyl alcohol, 99 percent. The isopropyl alcohol (99 percent) and water in the resin component may be replaced by 375 pounds (55.5 gallons) of ethyl alcohol. The isopropyl alcohol (99 percent) in the acid component may be replaced by 102 pounds (15.0 gallon) of ethyl alcohol.

3.2 Manufacture. - The component ingredients of the acid component shall be mixed until uniform in composition. The component raw materials of the resin component shall be mixed and ground as required to produce a product which is uniform, homogeneous, free from grit, entirely suitable for the purpose intended, and both components shall

be in full conformity to the requirements of this specification.

3.3 Quantitative requirements. - The quantitative requirements which are in Table II, shall be criteria by laboratory tests as specified in paragraph 4.3, that the coating has been manufactured in accordance with the formula.

Table II - Quantitative Requirements

	Minimum	Maximum
<b>Characteristics of resin component</b>		
Pigment, percent by weight of paint	-9.5	11.0
Volatiles, percent by weight of paint	79.0	81.5
Nonvolatile vehicle, percent by weight of paint (calculated by difference)	8.5	10.0
Ratio of pigment to nonvolatile vehicle by weight	9.7 to 9	10.3 to 9
Coarse particles and skins, as residue retained on Standard No. 325. mesh sieve (Spec. RP-S-356) percent by weight of resin component	---	0.5
Viscosity, Krebs units	63	75
Weight per gallon, pounds	7.3	7.7
Fineness of grind	6	--
Chromium oxide (CrO <sub>3</sub> ), percent by weight of pigment	13.5	--
Zinc oxide (ZnO), percent by weight of pigment	57.0	--
<b>Distillation</b>		
Initial boiling point °C.	75	82
Temperature at 80 ml. point, °C.	--	85
Temperature at 105 ml. point, °C.	116	--
End point temperature, °C.	--	120
Volume at end point, ml.	115	--
<b>Characteristics of acid component</b>		
Phosphoric acid, percent by weight	15.0	16.5
<b>Distillation</b>		
Initial boiling point	75	82
Temperature at 105 ml. point, °C.	--	83
Volume at end point, ml.	125	--
Maximum temperature during distillation, °C.	--	102
Weight per gallon, pounds	7.5	7.9
<b>Characteristic of pretreatment primer</b>		
Time of drying hard, minutes	--	30

**3.4 Qualitative requirements.-**

**3.4.1 Odor.-** The odor of the resin component and of the acid component shall be normal for the volatiles permitted when tested as specified in 4.3.1.

**3.4.2 Color.-** The color of the coating after drying shall be characteristic of the pigments specified in table II.

**3.4.3 Water in resin component.-** There shall be no indication of water present in the resin component when tested as specified in 4.3.4.

**3.4.4 Butanol.-** Butanol shall be present when the coating is tested as specified in 4.3.5.

**3.4.5 Adhesion.-** The mixed coating shall exhibit good adhesion when applied to freshly cleaned aluminum, steel, and galvanized steel panels to a dry film thickness of 0.3 to 0.5 mil.

**3.4.6 Compatibility.-** There shall be no evidence of incompatibility in any of the ingredients of the mixed coating when tested as specified in 4.3.8.

**3.4.7 Mixing and application properties.-** When tested as specified in 4.3.9, the acid and resin components shall form a smooth and homogeneous mixture, and shall show no signs of thickening or gelation when examined 24 hours after mixing. The components shall mix readily at any temperature between 40° and 90° F., and shall be suitable for spray application within the above temperature range.

**3.4.8 Condition in container (resin component).-** The product shall be capable of being remixed to a smooth uniform consistency and shall not liver, shall not exceed 85 Krebs units in viscosity nor exceed one hour dry hard time (for pretreatment coating), shall not curdle, gel nor show any other objectionable properties for at least one year after date of manufacture.

**4. QUALITY ASSURANCE PROVISIONS**

**4.1** The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the



# MIL-P-15326A

Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality assurance shall be provided in accordance with method 1031 of Standard FED-STD-141.

4.2.1 Ingredient materials. - A pint sample from each lot of the polyvinyl butyral resin and zinc chromate and when requested by proper authority, a one pint sample from each lot of the other ingredient materials shall be taken by the Government representative for test purposes.

## 4.3 Test procedures.

4.3.1 The following tests shall be conducted in accordance with the methods specified in Standard FED-STD-141:

Test	Applicable method
Pigment (using ethyl alcohol as extraction mixture) .....	4021
Volatiles .....	4041
Nonvolatile vehicle (calculated by difference) .....	4041
Coarse particles and skins (using alcohol as wash liquid) .....	4092
Viscosity .....	4291
Weight per gallon .....	4184
Fineness of grind .....	4111
Odor .....	4501

## 4.3.2 Pigment analysis.

4.3.2.1 Preliminary separation. - Weigh out a 2.000 gram (gm.) sample of the pigment and transfer to a 250 ml. beaker. Moisten the pigment with acetone and add 25 ml. of 1:4 sulfuric acid. Let stand on steam bath for 1 hour with occasional stirring. Filter, wash with 1:4 sulfuric acid free of chromium, and transfer filtrate to a 250-ml. volumetric flask. Dilute filtrate to exactly 250 ml. and reserve for zinc and chromium determinations.

4.3.2.2 Zinc oxide. - Remove a 50.0-ml. portion from the volumetric flask and transfer to a 400-ml. beaker. Dilute to 150 ml. with distilled water and add 25 ml. of a 25 percent solution of tartaric acid. Make just neutral to litmus paper with ammonium hydroxide and add 25 ml. of formic acid mixture. (To 400 ml. formic acid add 60 ml. ammonium hydroxide. Dissolve 500 gm. of ammonium sulfate in approximately 1 liter of distilled

water. Mix the two solutions and add sufficient water to make 2 liters.) Care should be taken to adjust the acidity to the proper pH for the quantitative precipitation of the zinc as sulfide. Pass a rapid stream of hydrogen sulfide through the solution for 30 minutes. Filter off the precipitated zinc sulfide and wash with distilled water saturated with hydrogen sulfide. Put the precipitate and paper into a tared porcelain crucible, dry the paper, and then char at low heat until the paper is consumed. Increase the heat to 1,000°C., and ignite for 10 minutes. Let cool in desiccator and weigh as zinc oxide.

4.3.2.3 Chromium trioxide. - Remove a 50.0-ml. portion from the volumetric flask. Transfer to a 600-ml. beaker. Dilute to 300 ml. with distilled water and add 15 ml. of concentrated sulfuric acid and 3 ml. of concentrated nitric acid. Bring to a boil, then add 1 ml. of 2.5 percent silver nitrate solution and 1 ml. of 0.1 N potassium permanganate. Slowly add 10 ml. of 20 percent ammonium persulfate, freshly prepared. The pink color of permanganate should persist after 10 minutes of boiling, adding more ammonium persulfate if necessary and boiling 10 minutes after last addition of ammonium persulfate. Five ml. of 1:3 hydrochloric acid should then be added and the solution boiled for 10 minutes after the permanganate color is destroyed. Cool to 20°C. and add standardized ferrous ammonium sulfate solution (approximately 0.1N) until approximately 5 ml. in excess has been added. Now titrate with approximately 0.1N potassium permanganate solution (which has been standardized against sodium oxalate) until an excess of approximately 5 ml. has been added. Adjust to the correct end point by careful addition of the standardized ferrous ammonium sulfate solution. Multiply the volume of permanganate solution used by the ferrous ammonium sulfate equivalent of 1 ml. of standardized permanganate solution, subtract the product from the amount of ferrous sulfate used and calculate the amount of chromium as  $CrO_3$ . To determine the ferrous ammonium sulfate equivalent, take as much of the ferrous ammonium sulfate as was used in the test, dilute in a solution having the same volume and acidity, titrate as above with the permanganate solution, and calculate from the data obtained.

4.3.3 Distillation. - Place a 150-gm. sample of resin component in a 500-ml. round bottom flask, attach a water condenser, and immerse the flask in an oil bath. Heat the oil bath and distill over all the thinner. The temperature of the bath shall not exceed 200°C. at any time. Place 100.0 gm. of thinner distilled from the resin component (or 150 ml. if distilling the acid component) in a 250-ml. flask which has a ground glass neck to fit a 6-ball Snyder column or the equivalent. The column shall be jacketed with an air condenser and provided with a fractionating head and a stopcock for controlling

the amount of distillate being removed. The rate of removal of distillate shall be 1 ml. per minute. The flask shall be heated by means of an oil bath to provide a rapid reflux. The temperature of the bath should be approximately 175° to 200°C. When fractionating the thinner distilled from the resin component, change receivers when the distillation temperature reaches 117°C. to obtain the portion of the distillate to be used in the test for butanol (see 4.3.5)

**4.3.4 Water in resin component.**— The presence of water in the resin component shall be determined by the following test on the thinner removed from the resin component by distillation. Upon completing the distillation, mix well and remove a 10.0 portion to a 100 ml. glass-stoppered graduated cylinder. Add 30 ml. of c.p. benzol and shake well. A clear solution should be obtained indicating the absence of water. When water is present, the solution will appear cloudy.

**4.3.5 Butanol.**— The presence of butanol shall be determined on the fraction of the distillate from the resin component which distills at 117 to 119°C. This material shall have a refractive index of 1.395 to 1.398 at 25°C.

**4.3.6 Phosphoric acid.**—

**4.3.6.1 Reagents.**—

**4.3.6.1.1 Standard sodium hydroxide,** approximately 2.0N. — Dissolve approximately 30 gm. of c.p. sodium hydroxide in a liter of CO<sub>2</sub>-free, distilled water. Standardize against National Bureau of Standards potassium acid phthalate in accordance with the instructions provided in the National Bureau of Standards Certificate of Analysis.

**4.3.6.1.2 Phenolphthalein indicator.**— Dissolve 1 gm. of phenolphthalein powder in 50 ml. of pure 95 percent ethyl alcohol and dilute the resulting solution with 50 ml. of distilled water.

**4.3.6.2 Procedure.**— Transfer approximately 15 gm. of acid component to a clean, covered, previously tared Erlenmeyer flask and weight accurately. Pipette 5 ml. of sample into a 500-ml. Erlenmeyer flask and allow 30 minutes for complete drainage of the pipette. Add 50 ml. of distilled water to the Erlenmeyer flask. Add 5 drops of phenolphthalein and 10 drops of methyl purple. 1/ Swirl the purple solution carefully. Titrate this solution with the standardized sodium hydroxide to the appearance of a green color (methyl purple end point). An intermediate gray color precedes the green and serves as a warning. 1/ Methyl-purple indicator obtainable from laboratory supply companies.

of the approaching end point. Note the burette reading. Titrate the green solution with standardized sodium hydroxide to the appearance of a purple color (phenolphthalein end point). Note the burette reading. Calculate the percent H<sub>3</sub>PO<sub>4</sub> as follows:

$$\text{Percent H}_3\text{PO}_4 \text{ (by weight)} = \frac{4.9N(A + B)}{G}$$

where:

- G = weight of samples of acid components taken.
- N = normality of sodium hydroxide.
- A = milliliters sodium hydroxide to methyl purple end point.
- B = milliliters sodium hydroxide from methyl purple end point to phenolphthalein end point.
- and A = B ± 0.5 (ml.)

**4.3.6.2.1** If A does not equal B ± 0.5 ml., the presence of acidic components other than phosphoric acid is indicated. In such cases, the acid component shall be analyzed for phosphoric acid by any suitable standard gravimetric procedure.

**4.3.7 Drying time.**— Drying time shall be determined by method 4061 of Standard FED-STD 141, except that the primer shall be brushed out on a steel panel to a dry film thickness of 0.3 to 0.5 mil and the specified conditions of temperature and humidity shall apply only for referee tests in case of dispute. All other tests shall be conducted under prevailing laboratory conditions.

**4.3.8 Compatibility.**— Compatibility with thinner shall be determined in accordance with method 4203 of Standard FED-STD-141. Fifty ml. of mixed primer and 50 ml. of ethyl alcohol conforming to grade III of Specification O-E-760 shall be used. The ethyl alcohol shall be added slowly to the rapidly stirred coating. Observations shall be made immediately after mixing and also 30 minutes after mixing.

**4.3.9 Mixing and application properties.**— Add slowly one part by volume of acid component with rapid stirring to four parts by volume of resin component. Then allow to stand 24 hours in a closed tinplate, terneplate, or steel container.

## 5. PREPARATION FOR DELIVERY

**5.1 Packaging.**— Packaging shall be level A or C as specified (see 6.2).

**5.1.1 Level A.**— Pretreatment primer shall be furnished in one or 5-gallon units as specified (see 6.2).

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### 1.1.1 One-gallon.-

1.1.1.1 Acid component.- One-fifth gallon (quart) of acid component shall be furnished in minimal 1-quart capacity heavy weight, semi-rigid, plastic insert (cubic in shape) molded of polyethylene. The outside dimensions of insert shall be approximately 4 by 4 by 4 inches. The average thickness shall be .020 inches with a minimum thickness of .008 inch at any point. Each insert shall be provided with a dispensing spout, formed integrally with the insert, shall be heat-sealed after filling. Each insert shall be packaged in a fiberboard box conforming to class 1 of Specification PPP-B-636, except the insert shall be die cut to provide for removal of the dispensing spout.

1.1.1.2 Resin component.- Four-fifth gallon of resin component shall be furnished in a one-gallon round can conforming to Type V, class 1 of Specification PPP-C-95. Plan B exterior painting and side seam striping shall be required. Cans shall be provided with wire handles which shall be galvanized or protectively coated to resist corrosion.

1.1.3 Unit packaging.- One package of acid component (see 1.1.1.1) and one can of the resin component (see 1.1.1.2) shall be packaged as a unit in a fiberboard box conforming to Specification PPP-B-636. The acid component package shall be centrally placed above the can of resin component and secured to prevent movement within the unit package by means of a corrugated die-cut form or collar.

### 1.1.2 Five-gallon.-

1.1.2.1 Acid component.- One-gallon of acid component shall be furnished in a nominal 1-gallon seamless, natural polyethylene bottle. The height of the bottle including the screw cap shall be not less than 11-1/2 inches nor greater than 13-inches. The wall thickness of the bottle shall be of minimum .010 inch. The opening shall be fitted with a 33 mm. buttress thread plastic screw cap lined with a polyethylene liner or other material which is resistant to the phosphoric acid alcohol mixture.

1.1.2.2 Resin component.- Four-gallon of resin shall be furnished in a 5-gallon capacity lug cover pail conforming to Type II of Specification PPP-P-384, olive drab color. Wire handles or balls shall be galvanized or otherwise protectively coated to resist corrosion.

1.1.2.3 Unit packaging.- One bottle of the acid component (1.1.2.1) shall be placed into the 5-gallon pail containing the resin component

so as to form a unit package and the pail shall be closed and tightly secured.

5.1.2 Level C.- Packaging shall be sufficient to afford adequate protection against deterioration and physical damage during shipment from the supply source to the using activity and until early use.

5.2 Packing.- Packing shall be level A, B or C as specified (see 6.2).

### 5.2.1 Level A.-

5.2.1.1 One-gallon unit packages shall be packed in containers conforming to any one of the following specifications at the option of the contractor:

#### Specification

PPP-B-585  
PPP-B-591  
PPP-B-601  
PPP-B-621  
PPP-B-636  
MIL-B-10377

#### Type or Class

Class 3 Use  
Overseas Type  
Overseas Type  
Class 2  
Class 2  
Overseas Type

Shipping containers shall have caseliners conforming to Specification MIL-L-10547. Caseliners shall be closed and sealed in accordance with the appendix to Specification MIL-L-10547. Caseliners for Class 2 fiberboard boxes conforming to Specification PPP-B-636 may be omitted provided all corners and edge seams and manufacturer's joints are waterproofed with tape in accordance with the appendix to Specification PPP-B-636. Boxes shall be closed, strapped or banded in accordance with the applicable box specification or appendix thereto. The gross weight of wood or wood-cleated boxes shall not exceed 200 pounds. When specified (see 6.2) unit fiberboard boxes (see 1.1.1.3) conforming to class 2 of Specification PPP-B-636, closed, sealed, strapped or banded as specified herein may be used as the shipping container.

5.2.1.2 Five gallon unit packages will not require any additional packing. When specified (see 6.2), 5-gallon pails shall be palletized in accordance with Standard MIL-STD-147.

### 5.2.2 Level B -

5.2.2.1 One gallon unit packages shall be packed in containers conforming to any one of the following specifications at the option of the contractor:

#### Specification

PPP-B-585  
PPP-B-591  
PPP-B-601  
PPP-B-621

#### Type or Class

Class 1 or 2 Use  
Domestic Type  
Domestic Type  
Class 1

MIL-P-15328B  
AMENDMENT - 1  
3 June 1966

## MILITARY SPECIFICATION

### PRIMER, PRETREATMENT

(FORMULA NO. 117 FOR METALS)

This amendment forms a part of Military Specification MIL-P-15328B, dated 5 May 1961, and is mandatory for use by all Departments and Agencies of the Department of Defense.

Page 1, paragraph 2.1: Delete reference to "O-E-760".

Page 2, table I, Note 4: Delete reference in table I and footnote.

Page 3, paragraph 3.4.3: Delete and substitute:

"3.4.3 Water in resin component. - Water shall be added to the resin component in the amount specified in table I. Presence of excess water shall be determined in accordance with 4.3.4."

Page 3, paragraph 3.4.6: Delete.

Pages 3 and 4, paragraphs 4.1, 4.2 and 4.2.1: Delete and substitute:

"4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

"4.2 Quality assurance. - Quality assurance shall be provided in accordance with method 1031 of FED-STD-141.

"4.2.1 Ingredient materials. - For quantities of primer of 250 gallons or over, one pint of each ingredient shall be taken by the government representative for verification test purposes prior to acceptance (see 4.2.3).

"4.2.2 Finished primer. - For quantities of primer of 250 gallons or over, two quarts of each lot shall be taken by the government representative for verification test purposes prior to acceptance (see 4.2.3).

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AMENDMENT - 1

"4.2.3 The samples taken by the government representative as specified in 4.2.1 and 4.2.2, shall be forwarded to the Chemical Laboratory, Norfolk Naval Shipyard, Portsmouth, Virginia, or to the Industrial Laboratory, Mare Island Division, San Francisco Bay Naval Shipyard, Vallejo, California."

Page 5, paragraph 4.3.4: Delete and substitute:

"4.3.4 Water in resin component. - The presence of excess water in the resin component shall be determined by the following test on the thinner removed from the resin component by distillation; mix well and remove a 10.0 ml. portion to a 100 ml. glass-stoppered graduated cylinder. Add 90 ml. of c.p. benzol and shake well. Formation of a cloudy solution indicates the presence of excess water. Thinner removed from properly prepared resin component when tested as specified should give a clear solution."

Page 5, paragraph 4.3.8: Delete.

Page 7, paragraph 5.3.2, under "Instruction for use", line 19: After "for use" add "(If the resin component is gelled or thickened, do not add the acid component as an unsatisfactory product will result. The gelation is a temporary condition resulting from cold storage and can be corrected by placing the resin component in a heated room or in a warm water bath until it liquifies.)"

Page 7, Notice: Delete.

Custodians:

Army - MR  
Navy - SH  
Air Force - 69

Preparing activity:

Navy - SH  
(Project 8010-0335)

Review activities:

Army - MR, MI, MU  
Navy - SH, CG, SA, YD  
Air Force - 69

User activities:

Army - GL, MO  
Navy - AS, MC, MS, OS

Specification	Type or Class
DDP-D-656	Class 1
MIL-D-10377	Domestic Type

Box closure shall be as specified in the applicable this specification or appendix thereto. The gross weight of wood or wood-cleated boxes shall not exceed 200-pounds. When specified (see 6.2), unit fiberboard boxes (see 5.1.1.1.3) closed as specified herein may be used as the shipping container.

6.2.2.2 Five-gallon unit packages will not require any additional packing. When specified (see 6.2), 5-gallon pails shall be palletized in accordance with Standard MIL-STD-147.

6.2.3 Level C.- Packing shall be accomplished in a manner which will insure acceptance by common carrier and will afford protection against physical damage during direct shipment from the supply source to the using activity for early use. The shipping containers or method of packing shall conform to the Interstate Commerce Commission Regulations, Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

6.3. Marking.- In addition to the labelling specified in 5.3.2 and any special marking required by the contract or order, interior packages, exterior shipping containers and palletized unit loads shall be marked in accordance with Standard MIL-STD-129 including the following:

Name of material (including resin and acid components, and indicating content and quantity for each)  
Contractor's name  
Contractor order number  
Federal Stock number  
Specification number  
Manufacturer's batch number  
Date of manufacture

6.3.1 Marking shall also conform to the requirements of Interstate Commerce Commission Regulations.

6.3.2 Labelling.- The container shall have securely affixed a warning label of appropriate size similar to class 2 of Specification MIL-L-19263, or shall be lithographed or stenciled with a reasonable likeness thereof. Under "contains" shall be inserted phosphoric acid and the appropriate amount. For unit containers that also serve as shipping containers any conflict with ICC Regulations shall be resolved by reasonable modification of size of label or use of warning statement without label

design. In addition, the one gallon can in 5.1.1.1.2 and the five gallon pail in 5.1.1.2.2 shall be marked with the following information by stencil, lithograph, or securely affixed label:

"Instruction for use.- Primer pretreatment primer is intended for use on clean metal surfaces of all types as a treatment prior to the application of the primer system. The purpose of the material is to increase the adhesion of the primer system. It is not intended as a permanent protective primer in itself although some protection is afforded for short periods of time. However, to insure best results the pretreatment should be coated with primer as soon as practicable. The material is sufficiently dry for recoating within 15 to 30 minutes after application. The pretreatment may be applied on damp surfaces (preferably by brushing) but should not be applied to wet surfaces or in rainy weather. The dry film thickness should be about 0.3 mil, and not more than 0.5 mil. The resin component should be well stirred and then all of the acid component added slowly with stirring; the pretreatment is then ready for use. The pretreatment is most effective when freshly mixed and must be used within 8 hours after the addition of the acid component. The quantity of pretreatment mixed for use shall be the amount required for immediate application. The acid component is not thinner. It is a necessary activator and must be used exactly as directed."

## 6. NOTES

6.1 Intended use.- Primer pretreatment coating is intended for use on clean metal surface of all types as a treatment prior to the application of the coating system.

6.2 Ordering data.- Procurement documents should specify the following:

- Title, number and date of this specification.
- Size of container (see 5.1.1).
- Level of packaging and level of packing required (see 5.1 and 5.2).
- Whether palletization is required (see 5.2.1.2 and 5.2.2.2).

Notice.- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by

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implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture,

use, or sell any patented invention that may in any way be related thereto.

Custodians:

Army - QMC

Navy - Ships

Air Force - MOA

Preparing activity:

Navy - Ships

(Project 8010-0:55)

# MIL-P-15328 (Ships)

## Coating, Pretreatment, Wash Primer (For Metals), (Formula 117)

Formula	Specifications	Pounds Per 100 Gallons
Base Solution	Type I	56.0
Chromate-vinyl resin XYHIL		54.0
Zinc Chromate, insoluble		8.0
Magnesium silicate		
Lampblack		0.6
Isobutyl alcohol	MIL-M-15173 (Type A or D)	125.0
Isobutyl alcohol	777-B-846	580.0
Diluent	O-A-300, gr. III	
Phosphoric acid (85%)	O-1-313, Class A	28.0
Water (maximum)		25.0
Water (alcohol)	O-A-300, gr. III	102.0

\* Isobutyl alcohol (90%) may be substituted on an equal volume basis. (CGS-5211-7a Coast Guard Service at above, with modifications on quality requirements).

Figure 7

Figure 7, MIL-P-15328, illustrates the basic wash primer formulation. This is essentially the same as the original WP-1 formulation and the U. S. Corps of Engineers Vinyl Wash Coat Specification. In this formulation the mixture will "gel" within five minutes after the addition of the acid diluent if the total water content is below 2.4 parts. When the water content is 4.6 or above, pigment flocculation, leading to rough coatings, will occur.

Butyral resins maintain high electrical resistance when immersed in water as illustrated by Figure 8. Since vinyl butyral resins can be insolubilized by the ions of metal, the polymer definitely is insolubilized by the wash primer reaction. Harold Rosenbloom, in a recent article, states that oxidation plays an important role in the wash primer reaction. Chromate, derived from the pigment, dissolves in the alcoholic phosphoric acid solvent to provide the conditions for oxidation. The phosphoric acid reacts with the vinyl butyral resin only in a system where chromium is being reduced.

Talc can be added to improve the pigment suspension, and white or black pigments can be used for color when included in addition to the basic zinc chromate. The degree of pigment dispersion affects the performance of the wash primer; the better the dispersion, the better the performance.

Good performance is ensured if the resin/pigment/acid ratio is kept at 2/2/1. Development work on the proper formulation for specific substrates indicates that the acid portion of the metal conditioner should be reduced by 75% for application to magnesium to avoid hydrogen formation and subsequent blistering.

The wash primer is prepared by pebble milling all the base solution ingredients with a good dispersion is obtained. Steel balls should not be used since iron contamination might affect the performance of the wash primer. Immediately prior to use, the acid diluent is added slowly to the prepared base solution with good mixing. Mixing should be done in containers free from oil, grease, old paint, or naphtha thinners. Tests

indicate that as little as 5% mineral spirits in the wash primer will detract from the adhesive qualities.

Approximately 8 hours after the acid has been mixed with the pigmented base solution, there is a noticeable decrease in adhesion of the primer to many surfaces. However, the adhesion to steel is regained gradually on aging of the coated metal. This loss of adhesive power continues with further aging of the wash primer until it entirely loses its ability to adhere. Unfortunately, this is not accompanied by gelation or color change which would give a visual indication that the wash primer has passed its useful period.

Base solutions should be stored in terne plate or similar non-reactive containers. The acid diluent should be stored either in glass-lined containers or containers lined with a baked phenolic or vinyl chloride-type coating.

The problem of relatively short storage life has been solved by certain formulation changes. By replacing the basic zinc chromate pigment with lead chromate, a metal conditioner can be prepared which will be stable for approximately 1 1/2 years after the addition of the acid diluent. Formula Suggestion XE-5220 (Figure 9), a typical one-package wash primer, provides a smoother surface than WP-1. It is more economical and is preferred where the coating is exposed to high humidity or immersed in fresh water. This formulation, however, is only effective over ferrous metals. XE-5220 also has poorer heat stability than WP-1 which limits its use to air-dry systems.

A clear metal conditioner has been developed which possesses the same good adhesion to all metals evidenced by WP-1, yet which has a

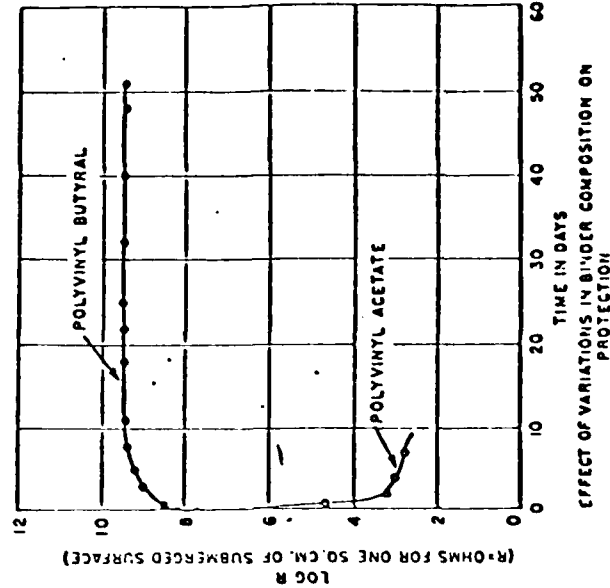


Figure 8  
EFFECT OF VARIATIONS IN BINDER COMPOSITION ON PROTECTION



January 1975

THE COMMONWEALTH OF MASSACHUSETTS.

DEPARTMENT OF PUBLIC WORKS

RESEARCH & MATERIALS DIVISION

M 7.02.20 Zinc Rich Primer, Organic Vehicle Type

- A. SCOPE: This specification covers a one-package, thermoplastic organic, zinc-rich primer whose mechanism of dry is that of solvent release. It is intended for use as a primer on clean steel structures exposed to air. The surface preparation of the steel must be by blast cleaning (SSPC-SP10).
- B. GENERAL: The paint shall comply with the general requirements for Paint and Protective Coatings M 7.00.00.
- C. MATERIALS: The component ingredients shall comply with the following specifications:

Zinc Dust	1	ASTM D520, Type I
Red Iron Oxide	2	ASTM D84, Class I
Zinc Oxide		ASTM D79, Type I
Polyaryl Ether	3	
Ethylene Glycol Monoethyl		
Ether Acetate		MIL-E-7125
Toluene		TT-T-548

1. Metallic Zinc Content shall be 95% by weight min.

Except that  $Fe_2O_3$  shall be 98.5% minimum and oil absorption 21.

January 1973

M 7.02.20

<sup>3</sup> A polyhydroxy polyalkaryl polyether of the following properties:

Specific Gravity	1.18
Viscosity of 40% solids in methyl ethyl ketone, Brookfield RVF 20 rpm, No. 5 spindle	5500 to 7700 cps
Reduced viscosity (0.2 g/100 ml dimethyl formamide)	0.4 to 0.6
Ultimate tensile strength	9000 to 9500 psi
Ultimate tensile elongation	50 to 100%
Softening temperature	212°F
Bulking value	9.83 lb/gal

When dried upon a potassium bromide disc, a film of the primer vehicle shall have infrared absorption maximums at the same wave lengths and to the same relative degree as that shown by the attached curve.

C. COMPOSITION (By Weight)

Ingredient	62.33 min.	Type I Red Tint	Type II Gray
White Dust	95.0 min.		95.0 min.
Red Iron Oxide	1.5 max.		
Yellow Oxide			1.5 max.
Thiokol B			3.5 max.

Vehicle

37.7% max.

Polyaryl Ether	19%
Ethylene Glycol Monoethyl	
Ether Acetate	66.8%
Toluene	14.2%

E. Paint Characteristics: shall conform to Table 1.

Table 1

Volatiles @ 105°C, % by wgt.	28-32
Weight per gallon, pounds	17.2-18.0
Viscosity, KU's @ 77°F	100-120
Metallic Zinc, % by wgt of extracted pigment Fed Test Method No.141, Method 7221	90.2 min
Dry Time @ 77°F, 50%	
R.H., 6 mil wet thickness	
set-to-touch hours	3/4 max.
Dry hard hours	5 max.
Storage Life, years	1 min.

F. Cured Coating Characteristics

F.1 Pencil Hardness

When applied to a plate glass panel with a 6 mil gap clearance Doctor Blade and cured for 15 days at 77 + 5°F and 50 + 5% relative humidity, the coating shall have the following property.

Pencil Hardness	B min.
-----------------	--------

F.2 Sagging

When applied by air or airless spray to a minimum dry film thickness of 1.5 mils on sandblasted steel having an anchor profile pattern of one to 1.5 mils, the mixed paint shall completely wet the surface of the steel with no evidence of dry spray particles or sagging.

F.3 Flexibility

When applied to a wet film thickness of 6 mils on a metal panel corresponding to Federal Specification QQ-S-636, the panel being previously cleaned by sandblasting to produce a one to 1.5 mil anchor pattern and cured for 15 days at a relative humidity of 50 + 5% and tested according to the Conical Mandril Test, Federal Test Method Standard No. 1 141, Method 6222, there shall be no loosening of the film above the point of the longest continuous crack.

#### F. 4 Corrosion

When a steel panel is sandblasted to white metal and coated with 3-4 mils dry film thickness of this coating and cured for 15 days at 75°F and 50 ± 5% relative humidity and diagonally scribed to expose bare steel, there shall be no underfilm corrosion on the surface of the panel extending beyond the scribed lines after 1,000 hours when tested according to ASTM Designation B-117.

#### G. APPLICATION

The paint shall be thinned, using a power agitated stirrer, with not exceeding one volume of a mixture of 82 percent by volume of ethylene glycol monoethyl ether acetate and 18 percent by volume toluene to 4 volumes of paint prior to use to produce a smooth uniform coating.

After thinning and thorough mixing, the primer shall be strained through a 30-60 mesh screen or double layer of cheesecloth. There shall be no undispersed agglomerates of zinc pigment remaining in the paint after mixing.

Steel surfaces shall be blast cleaned according to Steel Structures Painting Council Specification SSPC-SP10. (Near White Blast Cleaning).

After blast cleaning the anchor pattern shall be a minimum of 1-1/2 mils deep in a dense and uniform pattern of depressions and ridges.

Blast cleaning and painting will not be permitted when the relative humidity exceeds 85% as measured at the site of operations.

All paint shall be applied by spray methods except that areas inaccessible to spray application shall be brushed.

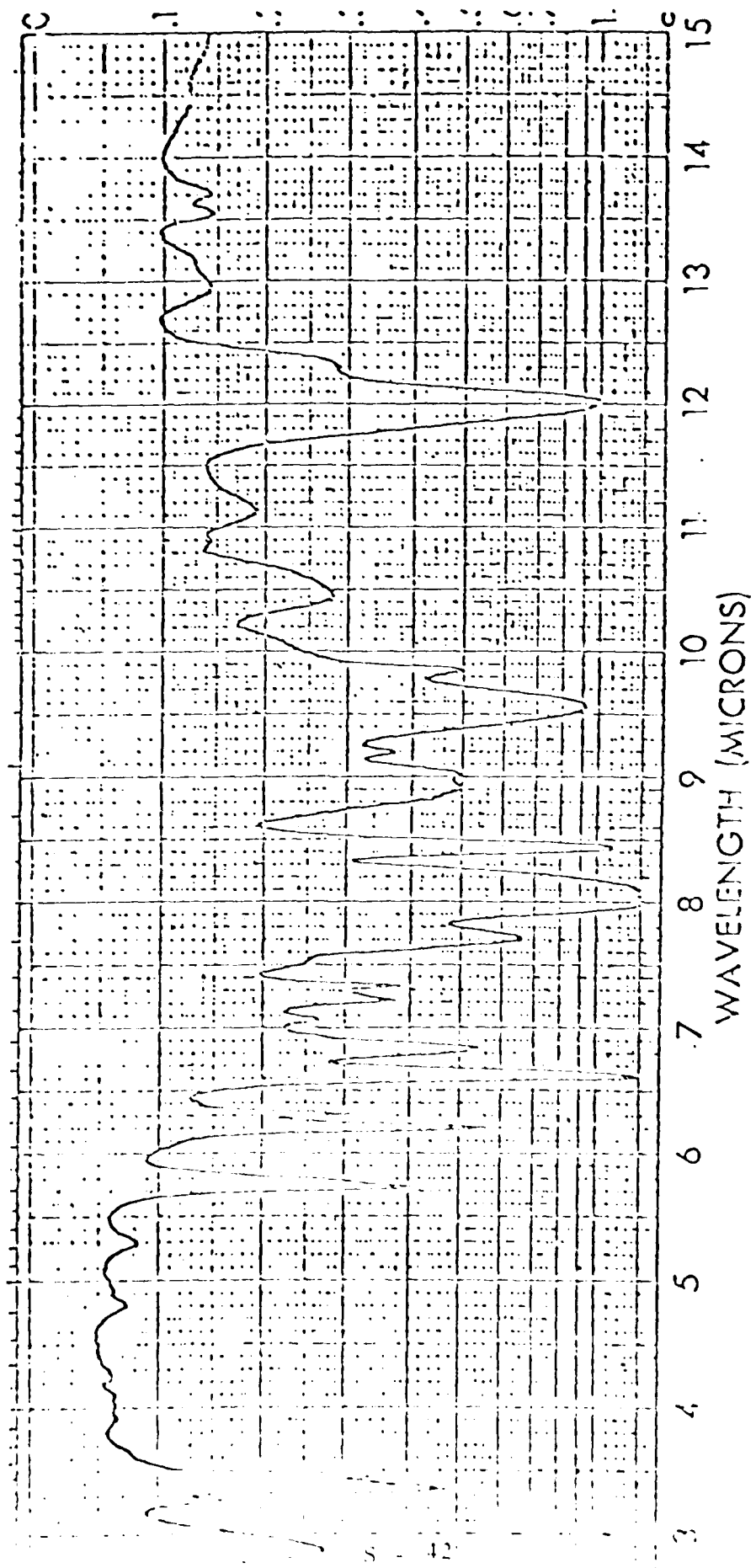
Coated surfaces which are damaged, faulty, or abraded and all exposed uncoated surfaces shall be cleaned by sandblasting and spot painted with this primer after erection and before application of the specified top coats.

First coat over cleaned steel surface shall be Type I, Red Tint. Second coat if required shall be Type II, Gray. If additional coats are required, they shall be alternating Type I and Type II. An agitated pot containing the paint shall be mandatory in all spray painting or brush application work. The agitator or stirring rod shall reach to within two inches of the bottom of the spray pot and shall be in motion at all times during paint application. Such motion shall be sufficient to keep the paint well mixed. The paint shall be stored in a cool place.

Complete instructions for use shall be included with each container of paint.

Whenever painting operations are interrupted, the zinc-rich primer remaining in the fluid hose shall be expelled from the hose. Spray equipment which is used for application of zinc-rich primer shall be thoroughly cleaned at the end of each work day with the thinner described under "Application of Coating". Prior to application of the finish coats, except for the fayed surfaces, all surfaces painted with zinc-rich primer shall be treated with vinyl wash primer conforming to the provisions in Specification M 7.04.10, "Vinyl Wash Primer" of the Standard Specifications. The zinc-rich primer shall be cured for at least 24 hours before application of the vinyl wash primer. The vinyl wash primer shall be applied in such a manner as to produce a wet film as the spray contacts the surface. It shall completely and uniformly cover the underlying surface.

The first finish coat shall be applied over the pre-treatment vinyl wash primer in not more than 72 hours.



THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS  
RESEARCH AND MATERIALS SECTION

M7.04 - Federal Specification for Paints and Primers

These specifications shall conform to the individual Federal Specifications as specified below and to Massachusetts Department of Public Works Specification. In case of any conflict between specifications, the Department Specifications shall take precedence.

M7.04.02 TT-P-25E	Primer, Paint, Exterior, (Undercoat for Wood, Ready-Mixed White and Tints
M7.04.03 TT-P-57b	Paint, Zinc Yellow-Iron Oxide-Base Ready-Mixed (Type II)
M7.04.04 TT-P-59E	Paint, Ready-Mixed, International Orange
M7.04.05 TT-P-61E	Paint, Exterior, Black, Ready-Mixed
M7.04.06 TT-P-615d	Primer Coating: Basic Lead Silico Chromate, Ready-Mixed
M7.04.07 TT-P-641G	Primer, Paint, Zinc Dust-Zinc Oxide (for galvanized surfaces)
M7.04.08 TT-E-543a	Enamel Undercoat, Interior, Tints and White
M7.04.09 MIL-P15146A	Paint, Outside, Dull-Black (Formula 104)
M7.04.10 MIL-P-15328B	Primer (wash) Pretreated, Green (Formula No. 117A for metals)
M7.04.11 MIL-P-21035	(Ships) Paint, High Zinc Dust Content, Galvanized Repairs
M7.04.12 TT-E-1593B	Enamel, Silicone, Alkyd Copolymer, Gloss (For Exterior and Interior use)

NEW YORK STATE  
DEPARTMENT OF TRANSPORTATION  
William C. Hennessy, Commissioner



1220 Washington Avenue, State Campus, Albany, New York 12232

October 29, 1979

1979

Mr. Fred Ordway  
Executive Vice President  
Artech Corp.  
2901 Telestar Court  
Falls Church, VA 22042

Dear Mr. Ordway:

In reply to your letter of September 19, this is to advise you that our Department does not normally specify zinc-rich paints or primers for our protective coating work. If a situation occurred where we felt that a zinc-rich paint system would be beneficial we would probably reference our requirements to a Federal or SSPC Specification.

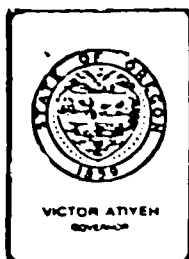
Very truly yours,

A handwritten signature in cursive script, appearing to read 'James J. Murphy'.

James J. Murphy, P.E.  
Director, Materials Bureau

DRB:js  
File: 8.1  
M920





MATERIALS SECTION  
SALEM, OREGON 97310

*Department of Transportation*  
HIGHWAY DIVISION

TRANSPORTATION BUILDING, SALEM, OREGON 97310

November 26, 1979

In Reply Refer to  
File No

Fred Ordway  
Executive Vice President  
Artech Corporation  
2901 Tlestar Court  
Falls Church, VA 22042

DEC 3 1979

Dear Dr. Ordway:

The Oregon State Highway Division has used inorganic zinc paint on several structures with results varying from good to poor. We believe that most of our problems with inorganic zinc have been due to application, though materials may have had a bearing too.

Our first application of inorganic zinc was on the Fremont Bridge in Portland, starting in 1968. The project specifications are enclosed. The inorganic zinc was applied at two different sites and two different brands were used. The brand that was applied at the warmer site survived, in good condition, four years of exposure without top coating. The brand that was applied at a colder site largely "disappeared" between application and final repair and top coating. It was a subject of expensive litigation.

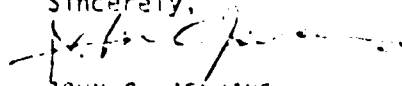
Another application of inorganic zinc was made as a spot repair job on the Columbia River Bridge at Astoria, on the coast, in 1970. Specifications for this work are also enclosed. The engineer in charge of the work said he had no significant problems with the paint or the contractor, but when the job was inspected in 1976, the repair inorganic zinc was in very poor condition due to extensive "chicken pox" rusting. The original red lead alkyd and basic lead silico chromate still looked good in those areas which had not required repair in 1970.

In 1975, we used an organic zinc paint on Thomas Creek Bridge. This is a high-level bridge located on the Southern Coast. This job has apparently been successful to date. A copy of these specifications are enclosed.

In 1977, we painted a small test panel on one end of the Astoria Bridge using an inorganic zinc paint supplied by the NASA Technology Applications Team, Stanford Research Institute. We don't have much detailed information about the material, but I am enclosing some data that was furnished with the paint. The test area looks good so far.

As you can see, we aren't able to give you much information on what systems will work, but maybe knowing what doesn't work also has some benefits.

Sincerely,

  
JOHN C. JENKINS  
Engineer of Materials

## Mount Bridge Section

Aluminum bolts, nuts and set screws shall be made from rod conforming to ASTM B 211, Alloy 2024, Temper T4. Finish bolts and nuts shall be given an anodic coating of at least 0.0002 inch in thickness and chromate sealed. As an alternate, anchor bolts and nuts may be galvanized mild steel bolts and nuts.

The anchor bolts connecting the aluminum post to the metal parapet shall be stainless steel bolts, material conforming to the requirements of ASTM A 276 Type 302 or 304.

Contact surfaces steel to aluminum, and concrete to aluminum shall be covered with a bearing pad consisting of a fabric and rubber body. The pad shall be made with new unvulcanized rubber and unused fabric fibres in proper proportion to maintain strength and stability. The surface hardness expressed in standard rubber hardness figures shall be 85 to 95 Shore A Durometer  $\pm$  10 durometer average. The ultimate breakdown limit of the pad under compressive loading shall be no less than 7000 pounds per square inch for the specified thickness without extension or detrimental reduction in thickness. The pads shall be furnished to specified dimensions with all bolt holes accurately located. The fabricated pad shall have a minimum thickness of 1/8 inch.

413-3.3(c) Contact surfaces - In the supplemental standard specifications, at the end of the first paragraph, delete the words "or MIL-C-1623, Type 1A."

## SECTION 414 - PAINTING NEW METAL STRUCTURES

### INORGANIC ZINC SILICATE-VINYL COATING

The requirements of the standard specifications for painting new metal structures are deleted in their entirety and the requirements of the Steel Structures Painting Manual Volume 2, Systems and Specifications, Second Edition, as modified herein, are substituted. Copies of the cited specifications may be obtained from the Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

#### Description

##### Scope of Work:

(a) The work includes the surface preparation, the furnishing of materials and the application of paints to all ferrous metal and aluminum surfaces including suspender strands of the bridge, full length within the limits of the contract extending from the tops of the

## Fremont Bridge Section

Fremont

concrete piers to the top of the arch. It also includes all structural steel casting and other ferrous metal items. Only a prime coat is required for the top of the orthotropic steel deck within the limits of the paving.

Certain adhesion properties are required in order to insure bond between the inorganic zinc primer and the bond coat of the epoxy asphalt paving. The inorganic zinc primer furnished must satisfy these adhesion requirements.

(b) Except as specified otherwise, all interior and exterior surfaces of structural steel members, castings and miscellaneous items shall be painted with one coat of self-curing inorganic zinc silicate primer and one coat of compatible high-solids vinyl paint to a combined dry film thickness of not less than 8 mils, over "white metal" blast cleaned surfaces. Interior and exterior surfaces of aluminum pipe and cast aluminum posts forming the parapet railing are not required to be painted.

stro

(c) Galvanized surfaces including but not limited to suspender strands, conduits, and ladder rungs shall receive one coat of a bonding primer or tie coat as recommended and supplied by the manufacturer of the coating system plus one coat of high-solids vinyl.

(d) Finish color shall be OSHD standard green. Standard color chips may be obtained from the Engineer of Materials, Salem, Oregon 97310.

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### Materials

Mixing Paint. Components of paint shall be factory prepared and mixed and shipped to the site or plant separately packaged in amounts that will provide unit volume quantities. The components of paints shall also be field mixed before applying and mixed during application in order to keep the pigments in uniform suspension as per manufacturer's instructions.

Manufacture. The ingredient material for each formula shall be mixed and ground to produce a homogeneous paint, free of grit, which will not thicken, liver, gel, curdle, or settle badly nor cake in the container. The manufacturer of the inorganic zinc primer and the vinyl finish coat shall provide a technical adviser to the paint applier to insure that the materials are properly applied in conformance with the manufacturer's recommendations.

Sampling. All samples will be taken by an authorized inspector or agent of the Materials Department. Minimum samples shall consist of:

## Fremont Bridge Section

### Vinyl Coat

Pigment and Driers,  $\frac{1}{2}$  pint each lot  
Vehicle and Thinner, 1 pint each lot  
Finished Paint, 1 one-pint sample each lot, 100 gal. max.

### Primer Coat

Pigment Component - 1 pint each lot, 100 gal. max.  
Liquid Component - 1 pint each lot, 100 gal. max.

Packaging and Marking. All paint shall be put in clean, strong, tight metal containers labeled to show the following:

Oregon State Highway Commission;  
Color, Use;  
Name and Address of Manufacturer;  
Date of Manufacture and Batch No.

### Inorganic Zinc Silicate Primer:

(a) General requirements - The primer coat shall be a two component, inorganic zinc silicate coating of the self-curing type, consisting of a pigment component and a liquid component. The coating shall be the product of a manufacturer included in the current Qualified Products List, current at the time of application, QPL-23236, under Military Specifications MIL-P-23236 (Ships) for Type I, Class 3 self-cured inorganic zinc silicate classification paint.

(b) Documented data - Prior to submitting a proposed manufacturer of inorganic zinc silicate paint to the engineer for approval, the contractor shall obtain three certified copies of coating history from the proposed manufacturer and submit them to the engineer. The case history shall be submitted in the form of fully documented information, with authenticated data, substantiating the past history and factual experience with the specified coating system from the stand-points of application and service life performance under specific conditions for at least three (3) years. Such information shall include complete formulation data, readily definable in a laboratory relating to the nature of the vehicle pigment and volatile, together with the weight per gallon, volume solids, and quality control procedures which will be followed in manufacturing and application of the specified coating.

In addition, the certified documented information shall show the results of all tests specified herein and shall certify that the paints meet all requirements of these specifications. Final acceptance will be based on test reports of samples obtained after delivery of the paint materials.

## Fremont Bridge Section

(c) Inorganic zinc silicate - Except as specified otherwise herein, inorganic zinc silicate shop primer shall meet the requirements of Type I, Class 3, Military Specification MIL-P-23236 (Ships), consisting of the "powder and liquid" components. The mixed paint shall contain a zinc pigment content of not less than eighty-five percent (85%) by weight of the total nonvolatile content. Zinc dust pigment shall be Type I, Regular, in accordance with Federal Specification TT-P-460. The liquid portion of the inorganic zinc coating shall be suitably formulated so that the mixed applied coating is wholly inorganic in nature in the cured state. Curing of the self-curing inorganic zinc primer prior to top coating shall be carried out in compliance with the manufacturer's printed application instructions of latest date.

(d) Properties of the cured coating - panel test:

(d-1) Physical Characteristics. The dried coating (7 days drying time) on a "white metal" blast cleaned steel panel, when scratched with the cut end of a common paper clip shall be abraded through to the steel only with considerable difficulty and shall not flake or show other signs of poor adhesion adjacent to the cut. When rubbed with the rounded end of the paper clip, the coating shall be burnished to the characteristic zinc appearance.

(d-2) Thickness Test. The cured coating, when tested by a Micro-Metries Co. Tooke Paint Inspection Gage by microscopic observation of a small V-groove cut into the paint film full depth to the steel substrate, shall show not less than three mils dry film thickness of inorganic zinc silicate coating film over the peaks of the blasted profile of the anchor pattern.

(d-3) Test Panel. A 4-inch wide by 6-inch high hot-rolled steel panel, "white metal" blast cleaned, with a centrally positioned inverted V area, 1/2-inch wide at the bottom of the panel and zero inches wide at the top of the panel, masked to prevent application of coating to this area, shall be coated and cured in accordance with the recommendations of the approved manufacturer of the inorganic zinc silicate paint. The coating shall be applied in a dry film minimum thickness of 3 mils. After curing, the mask shall be removed and, if masking was done by means of tape, any traces of remaining adhesive shall be removed by washing with mineral spirits. When subjected to 96 hours of salt spray in accordance with Method 6C61 of Federal Test Method Standard No. 141 with 5 percent salt solution, at least 10 percent of the uncoated area shall show red rusting that is no more than moderate in degree and at least 10 percent of the uncoated area shall be free of rust. In addition, no rusting shall be evident on the coated area.

## Fremont Bridge Section

### Vinyl Finish Coat:

(a) The vinyl finish coat shall be manufactured by the supplier of the inorganic zinc primer. The vehicle shall consist of polyvinyl chloride acetate copolymer resins with chemically inert plasticizers plus suitable solvents. The vinyl coat shall display compatibility with, and adhesion to the cured inorganic zinc primer film when applied over the inorganic zinc primer surface in accordance with manufacturer's printed Application Instructions of latest date.

(b) The vinyl finish coat shall be supplied in a single package at consistency ready for use.

(c) The vinyl finish coat shall be applied by brush or airless spray equipment as the contractor may elect and shall display a smooth satin finish and shall be available in the color required.

(d) The vinyl finish coat shall contain not less than 8.5 percent pigment (by volume) and 19.5 percent resin (by volume) for a total of no less than 28 percent solids by volume. Weight per gallon shall be  $9.4 \pm 0.2$  pounds at 77°F.

(e) The vinyl finish coat shall air dry at temperatures of 70°F above to a hard tough film within 4 hours, entirely by evaporation of solvents. It shall be dry to touch in about 20 minutes at 70°F.

(f) The vinyl finish coat, when applied in one coat over the inorganic zinc primer, or the tie coat if required, shall form a system fully resistant to salt air, fog, high humidity, condensation, rainfall, and temperature extremes and shall not exhibit any "pinholing" characteristics.

Applicable Standards and Specifications. The requirements of the following Steel Structures Painting Council, Military Specifications and Federal Specifications, latest revision, shall be complied with.

#### Steel Structures Painting Council

SP5-63	White Metal Blast Cleaning
PI3-64	Basic Zinc Chromate - Vinyl Butyral Washcoat
PA-1-64	Shop, Field and Maintenance Painting
Paint 9-64	White (or Colored) Vinyl Paint
PS 4.00 thru 4.05-64T	Vinyl Paint System
PS 12-64P	Zinc Rich Coating System in Preparation
Vis-1-67T	Pictorial Surface Preparation Standards for Painting Steel Structures

## Fremont Bridge Section

### Military Specifications

MIL-P-23236 (Ships)	Paint Coat Systems, Steel Ship Tank, Fuel and Salt Water Ballast
MIL-A-15206A	Aluminum Stearate
MIL-S-15191A	Diatomaceous Silicate

### Federal Specifications

TT-P-350b	Pigment, Lampblack Dry
TT-P-343	Pigment, Carbon-Black, Dry
TT-B-846b	Butyl Alcohol: Normal (for use in organic coatings)
TT-E-776b	Ethylene Glycol Monobutyl Ether (for use in organic coatings)
TT-E-781b	Ethylene Glycol Monoethyl Ether, Technical
TT-I-735d	Isopropyl Alcohol, Technical
TT-P-403a	Pigment, Magnesium-Silicate, Dry
TT-P-460	Pigment, Zinc-Dust (Metallic Zinc-Powder), Dry
TT-M-268b	Methyl, Isobutyl Ketone (for use in organic coatings)
TT-R-191d	Red Lead, Dry and Paste-in-oil, Type L Grade 97% Red Lead
TT-P-442	Pigment, Titanium-Dioxide, Type 3, Grade B (Rutile Non-Chalking Type)
TT-T-548c	Toluene; Technical
TT-P-458a	Pigment; Yellow-Iron-Oxide
TT-X916b	Xylene (for use in organic coatings) Federal Test Method Standard 141.

Inspection and Sampling. All paint materials will be inspected by the State at its expense, in accordance with the provisions of Article 6-7. The engineer may, at his discretion elect to accept the notarized certificates of the manufacturers of certain raw materials, covering compliance with the requirements of the specifications.

### Construction

Location of Work. The contractor shall apply the primer coat in the shop and the finish coat in the field after erection, except for "Inaccessible Surfaces" specified hereinafter.

In areas that might be affected, the final finish coat shall not be applied until after the steel is erected and all concrete and epoxy asphalt paving required is placed, the forms removed and all dirt and debris resulting from the placing of concrete and epoxy asphalt paving is cleared from the steel and all damage to previous paint coatings and work has been repaired. Repairs to damaged areas shall consist of clearing to bare metal and spot painting cleared area with the full number of coats specified.

## Fremont Bridge Section

### Preparation of Surfaces:

(a) Blast profile of the anchor pattern - All steel surfaces including faying surfaces for high strength bolted field connection shall be carefully prepared for painting by blast cleaning in strict accordance with Steel Structures Painting Council's SP 5-63 "White Metal Blast Cleaning", using any of the methods and abrasive materials described under paragraph 3, Procedures, except that, the height of profile of the anchor pattern, paragraph 3.8 and 3.9 shall be such as will afford a proper profile of the anchor pattern for the inorganic zinc paint, in the range of  $1\frac{1}{2}$  to 2 mils.

### (b) Blast cleaning:

(b-1) Blast cleaning of the steel shall be performed after fabrication in conformance with SSPC SP5 except that wet or water-vapor sandblasting will not be permitted. Care shall be taken to see that all welding flux and spatter and grease, oil and other surface contaminates have been completely removed.

(b-2) The blast cleaned surface just prior to the application of the primer coat shall visually match the appropriate Sa 3 plate of Steel Structures Painting Council Pictorial Surface Preparation Standards for Painting Steel Structures, No. 1, SSPC-Vis-1-67T.

### (c) High strength field-bolted connections:

(c-1) After erection, the primer coated areas of joints and splices, including boltheads, nuts, washers and the annular space between the steel plate and body stock of boltheads, nuts and washers shall be checked for proper priming and if necessary additional blast cleaning and primer shall be applied to assure that the full prime coat of 3 mils is available prior to application of the finish coat.

(c-2) No vinyl paint shall be applied to the contact surfaces of bolted connections.

Preparing Galvanized and Primed Surfaces: Galvanized areas shall be solvent cleaned to remove oil, grease or foreign contaminants; any rust and dirt shall be removed by solvent cleaning and brushed (bristle and/or wire brushes). The cleaned surfaces shall then be given one coat of a bonding primer or tie coat as recommended and supplied by the manufacturer of the coating system in accordance with the printed instructions for the product. The finish coat of vinyl paint shall then be applied as soon as the bonding primer or tie coat has dried and in conformance with the manufacturer's instructions.



## Fremont Bridge Section

### Painting:

(a) Number of coats and color - The paint system for the metal work shall consist of the following:

Primer Coat - Inorganic zinc-rich coating, a minimum dry film thickness of 3 mils above the blast profile ridges.

Tie Coat - If recommended by the manufacturer of the inorganic zinc primer and the vinyl finish coat, a tie coat shall be applied in conformance with the manufacturer's recommendations.

Finish Coat - High build vinyl finish coat, a minimum dry film thickness of 5.0 mils. Gloss and color to be OSHD Standard Green.

The dry film thicknesses shall be tested for the specified thicknesses with Micro-Metrics Tooke Paint Inspection Gage.

(a-1) If for any reason a cured coat of a specific coating fails to test to the specified dry film thickness, when tested with the previously specified Paint Inspection Gage, an additional coat of specific coating shall be applied. Inorganic zinc silicate painted surfaces which are damaged, faulty or abraded and all exposed uncoated surfaces shall be blast cleaned as previously specified, and spot painted with a zinc silicate coating recommended by the manufacturer, prior to the application of the specified vinyl top coat.

(b) Time of painting - The blast-cleaned surface, shall be primed within 8 hours after blasting when practicable, but in any event not later than 24 hours after blasting and also before any visible or detrimental rusting occurs. Paint shall not be applied to other than blast-cleaned and dry surfaces.

(c) Weather condition - Paint shall not be applied when the air temperature is below 40°F or when the relative humidity is 80 percent or higher, or when atmospheric conditions register less than 5 degrees above dew point temperature or, in the opinion of the engineer, conditions are otherwise unsatisfactory for the work. It shall not be applied upon damp or frosted surfaces.

Material painted under cover in damp or cold weather shall remain under cover until dry or until weather conditions permit its exposure in the open. Painting shall not be done when the metal is hot enough to cause the paint to blister and produce a porous paint film.

Fremont Bridge Section

(d) Application:

(d-1) Paint shall be applied both in the shop and in the field in conformity to Steel Structures Painting Council's currently applicable "No. 1 Shop, Field and Maintenance Painting" Application Specification, SSPC-PA 1-64 except as modified hereinafter.

(d-2) The full primer coat shall be applied by spraying over properly prepared entire surface areas. Particular care shall be taken to cover edges, corners, crevices, nuts, bolts, washers and welds.

(d-3) After erection, primed surfaces damaged or abraded by slings, packing blocks or any other cause, shall be repaired and restored to the full specified primer coat thickness. Any damaged area where bare metal is exposed shall be blast-cleaned to white metal for an area at least one inch outside the entire perimeter of the damaged area and the full thickness of the primer coat shall be placed on the cleaned area. The final finish coat shall not be applied until the primer coat on the patched areas has thoroughly cured throughout its entire thickness in conformance with the paint manufacturer's recommendations.

(d-4) In addition to the requirements of SSPC-PA I-64, Article 3.5.3.9, all inorganic zinc-primed surfaces shall be cleaned by pressure water cleaning using approved detergents. All surfaces shall be completely cleaned of all oil, grease, soil, dust, salt deposits or any other foreign matter prior to the application of the final vinyl coat.

(d-5) The final vinyl coat shall be applied by brush or by airless spray equipment so that a uniform film is obtained on all surfaces, including edges, bolts, nuts, washers, rivets and edges of fayed contact surfaces.

(d-6) In applying the paint system, each coating shall be sprayed in a cross-spray pattern - with special care taken to cover corners, crevices and edges. The sprayed film shall be such that a full wet film is produced at all times on the surface without sagging. If a sag or run appears it shall be brushed out immediately using a brush dampened in approved thinner. The brush should be drawn lightly and slowly over the sag in order not to reduce the thickness or uniformity of the film.

(d-7) Anchor bolts shall not be shop painted.

(d-8) Galvanized metal shall be specially treated and painted as specified herein.

## Fremont Bridge Section

(d-9) Humidity. Inorganic zinc silicate shop primer shall not be applied when the relative humidity is 80 percent or higher, or when atmospheric conditions register less than 5 degrees above dew point temperature or when the uncured coating may be exposed to dampness or rain, or under conditions prohibited by the manufacturer.

(d-10) Spray Equipment. Spray equipment for the application of inorganic zinc silicate prime coat shall conform to the recommendations of the approved manufacturer of the paint.

(d-11) Inorganic Zinc Coating. The mixed coating, before it is applied, shall be strained through a 30-60 mesh metal screen.

(d-12) While the final coat of paint is tacky but not dry one-half pound per square yard of clean silica sand shall be broadcast on platforms, and stair treads. After the paint has dried surplus sand shall be broomed off.

Stirring paddles on mechanical mixers shall reach to within one inch of the bottom of the stirring container.

(e) MODIFICATIONS TO SSPC-PA 1-64. THE FOLLOWING MODIFICATIONS ARE HEREBY MADE TO THE STEEL STRUCTURES PAINTING COUNCIL PAINT APPLICATION SPECIFICATIONS NO. 1, SSPC-PA 1-64. PARAGRAPH NUMBERING REFERS TO THE REFERENCED SPECIFICATIONS. THESE MODIFICATIONS ARE IN ADDITION TO PREVIOUS REVISIONS MADE HEREIN.

### 2. Definitions

2.1 In line 3 the word "pretreating" is hereby interpreted to refer exclusively to zinc-coated surfaces and castings (see Art. 414-3.3).

2.5 Maintenance Paint. Delete this sub-Article, without substitution.

### 3.5 Application of Paint

3.5.1.1 Application Methods - Except as specified otherwise herein, hot spray type spray equipment shall not be used for the application of paint.

3.5.1.2 Temperature - Paint shall not be applied when the temperature of the steel or paint is below 40°F. Surface temperature measurements shall be made with special surface thermometers such as the Pacific Transducer type or the Bureau of Reclamation portable gage or with a conventional thermometer taped or puttied firmly against the steel surface.

3.5.1.3 Moisture - Dew point temperature requirements shall be determined by measurements of dry and wet bulb thermometers with the readings referenced to a psychrometric chart.

## Fremont Bridge Section

3.5.1.8 Thickness - The dry film thickness of each coat of each paint system, when tested by the Micrometrics Thickness Gage, shall be not less than the following:

- (a) Zinc silicate prime coat . . 3 mils
- (b) Vinyl finish coat . . . . . 5 mils

In addition, the engineer will check the wet film thickness, and this thickness shall be compatible with the solids specified or the actual solids whichever is greater.

3.5.1.11 Intercoat Adhesion - Unless otherwise required by the manufacturer, undercoats shall not be treated in any manner, prior to the application of finish coat.

3.5.1.12 Contact Surfaces - Contact surfaces described in 3.5.1.12b shall be painted with a prime coat of the inorganic zinc silicate paint applied in the shop. The primer shall have a minimum dry film thickness of 3.0 mils.

3.5.1.14 All Spray Applications shall be made by means of airless spray or industrial pressure type.

3.5.1.17 Hot Air Spray Application - Delete without substitution.

3.5.1.18 Hot Airless Spray Application - Delete without substitution.

3.5.2 Shop Painting - Add the following:

The preparation of surface, number of coats, types of paint and dry film thickness per coat shall be as specified hereinbefore under the modifications of this specification SSPC-PA 1-64 and this section.

3.5.3.12 Field Welds shall be cleaned by white metal blast cleaning, SSPC-SP 5-53.

3.5.4 Maintenance Painting - Delete this Article without substitution.

3.5.5 Special Coatings - Except for 3.5.5.9, delete this Article without substitution.

(f) Inaccessible Surfaces. Surfaces of steel that will be inaccessible to convenient cleaning and painting after complete fabrication (such as the inside surfaces of boxed members or other surfaces) shall be cleaned in accordance with SP-5 prior to fabrication, and shall be painted after fabrication of individual members with one coat of inorganic zinc silicate prime coat, and one 5.0 mil coat of vinyl paint.

### Fremont Bridge Section

No painting will be required on the interiors of sealed members, or on the interiors of the trapezoidal stiffeners of the orthotropic deck.

In welded work, the cleaning, painting and fabrication shall be scheduled to result in a satisfactory paint system that is not damaged in any way by welding.

All weld areas shall be neutralized by blast cleaning supplemented by other treatment as required. All slag, spatter, and spall shall be removed.

(g) Other Requirements. Surfaces of iron and steel castings, either milled or finished, shall be given one coat of inorganic zinc silicate paint prior to shipment.

With the exception of butt joints and base plates, machine-finished surfaces shall be coated as soon as practicable after being accepted, with a hot mixture of white lead and tallow or other approved coating, before removal from the shop.

Erection marks for the field identification of members and weight marks may be printed with compatible vinyl paint, upon surface areas previously painted with the shop coat. Materials painted in the shop or on the ground at the job site shall not be loaded for shipment nor moved until paint is thoroughly dry, and in any case not less than 24 hours after the paint has been applied.

The contractor will be held responsible for all damages resulting from all cleaning and painting work involved in this contract. This includes all damages to buildings and to pedestrian, marine and vehicular traffic in the general vicinity of the work, damage to the bridge substructure or superstructure, and any and all damages to other persons or property that may be a result of the contractor's operations.

If, as determined by the engineer, traffic at the bridge site produces an objectionable amount of dust, the contractor, before the paint is applied and at his own expense, shall allay the dust for the necessary distance in the vicinity of the bridge and take any other precautions necessary to prevent dust and dirt from coming in contact with freshly painted surfaces.

Measurement and Payment. No separate measurement or payment will be made for paints and painting. Payment for the bonding primer and the finish coat on the suspender strands shall be included in the payment for the item "Suspender Strand". Payment for all other blast cleaning and painting work, including the blast cleaning and the inorganic zinc prime coat on the orthotropic steel deck within the limits of the paving, shall be included in the payments for the appropriate pay items for structural steel.

## Astoria Bridge

which shall be understood to be not less than 97-1/2% of the work, the engineer may, at his discretion, reduce the retained amount to an amount equivalent to not less than 200% of the contract value or estimated cost, whichever is greater, of the work remaining to be done.

### 9-14 Suspension of Payments

The contractor is hereby advised that in the event a complaint or charge of unlawful employment practices pursuant to the provisions of ORS Chapter 659 is filed against the contractor by anyone including the State Highway Commission, with the Commissioner of Labor and the Commissioner of Labor issues a cease and desist order as defined in ORS 659.010, no further payments will be made on this contract until such time as all of the provisions of the cease and desist order have been complied with by the contractor.

## MAINTENANCE PAINTING

Maintenance painting shall comply with all applicable specifications included under "Section 414 - Painting New Metal Structures", and the modifications which follow:

All structural steel in the spans to be painted shall be steam cleaned.

All surfaces (including lateral bracing) from the pier to the face of the third intermediate girder-stiffener for each deck plate girder span (a distance of approximately 15 feet) and all other surfaces which show rust or break-through shall be blast cleaned to white metal. The appearance of the surface after blast cleaning shall correspond with the appropriate pictorial standard as described in ASTM D2200. All foreign matter shall be removed by sweep blasting where necessary. See Drawing No. 17708 for details of steel girder spans, and Drawings No. 17712 through 17714 and 17752 through 17754 for deck truss spans.

Steam cleaning - Steam cleaning shall be by wet steam and water containing a detergent. Steam shall be supplied to the nozzle at a temperature of 300°F and minimum pressure of 150 psi gauge. Water consumption shall be not less than 200 gallons per hour.

## Astoria Bridge

The detergent shall be a cleaning compound complying with the following formula:

Sodium Meta Silicate	20-45%
Sodium Sesqui Carbonate or Soda Ash	35-45%
Sodium Tetra Phosphate or Sodium Meta Phosphate	2-4%
Naccanol or Triton X100	1-2%

This cleaning compound shall be incorporated in the cleaning water at the rate of 0.5% by weight.

Cleaning shall be performed in such a manner that the detergent is flushed off with hot water on the last pass of the nozzle. Any residue which remains on the cleaned surface or accumulates on sections which do not drain properly shall be flushed off with fresh water.

The structure shall be painted with one prime coat on bare metal, one undercoat on all surfaces, one stripe coat on all edges, bolts and bearing devices, and one finish coat on all surfaces.

The contractor shall provide a scaffold which will allow workmen and inspectors to touch the surface to be painted with their hand.

### Sequence of operations:

- (1) Steam clean all surfaces on spans specified.
- (2) Blast clean to white metal ends of girders as specified, rust spots on balance of girders and trusses specified.
- (3) Prime coat blast cleaned surfaces.
- (4) Undercoat all surfaces of spans specified.
- (5) Stripe coat all edges, bolts, nuts, rivet heads and bearing devices of spans specified.
- (6) Finish coat all surfaces of spans specified.

### Limitation of operations:

All areas blast cleaned (2) shall be prime coated (3) completely the same day.

Undercoating (4) shall be applied within 48 hours after steam cleaning(1).

## Astoria Bridge

Stripe coating (5) shall be applied within 48 hours after undercoating (4).

Finish coating (6) shall be applied within 48 hours after undercoating (4).

Failure to apply the paint coats within the time specified shall necessitate recleaning by steam prior to the application of paint.

Paint shall be applied to dry surfaces only.

Successive coatings shall be applied to dry paint only.

Paint shall conform to the following requirements:

The contractor shall provide a paint system which is compatible with the previously applied paint. For the contractor's information the previous paint system is red lead and alkyd enamel, the formulas for which are appended hereto.

The paint manufacturer shall provide technical assistance to the contractor and to the State to insure that the product supplied will be applied in accord with the manufacturer's best recommended practice.

\*Where manufacturers recommended thickness of coats exceed the minimum thickness herein specified, the contractor shall apply the coats at the manufacturers recommended thickness.

The contractor shall use only those thinners, equipment and practices which are recommended by the paint manufacturer.

The paint manufacturer shall certify by letter that his product is compatible with the existing system and that the new paint will not lift or damage the existing paint and also that the new film of paint will adhere to the existing paint film. The paint shall be listed on the latest edition of NavSEC Nore 9190 paint list.

The prime coat shall be inorganic zinc silicate, self curing type, conforming to Mil-P-23236, Type I, Class 3.



## Astoria Bridge

(The cured prime coat, when tested by a Micro-Metrics Co. Tooke Paint Inspection Gage by microscopic observation of a small V-groove cut into the paint film full depth to the steel substrate) shall show not less than three mils dry film thickness of inorganic zinc silicate coating film over the peaks of the blasted profile of the anchor pattern.

The undercoat, if required by manufacturers recommendations, shall comply with Formula 117 (MIL-P-15328) and shall be applied to provide a maximum dry coat thickness of 0.5 mil. Curing coats if required, shall be applied as the manufacturer recommends.

The stripe coat shall be the same product as the final color coat and shall be applied to all edges and the adjacent two inches, to all bolt heads, nuts and threads and to all bearing assemblies. It shall be a shade of green which can easily be distinguished from the final color coat for determination of film thickness and number of coats.

The finish coat shall be high build vinyl or chlorinated rubber gloss enamel tinted to match a standard color chip for O. S. H. D. formula number 317-64. This product shall provide a minimum 1.5 mils dry film thickness, tested as specified for the prime coat.

All paints shall be supplied by a single manufacturer.

414-4.1 and 414-5.1 Measurement and Payment. Payment for cleaning and painting the bridge will be made on the basis of the lump sum amount bid for the item:

"Clean and Paint Bridge"

Payment for the above item shall be understood to be full and complete payment for furnishing all labor, materials, tools, equipment, supplies and for other costs required to complete the work as specified, except partial payment for flagmen will be made as hereinbefore set forth.

## Astoria Bridge

### EXISTING PAINT SYSTEM

The existing paint system and formulas are as follows:

The number of coats and color on all spans except span No. 15 is as follows:

- |  |                         |
|--|-------------------------|
| 1. Prime Coat  | Formula No. 12-51       |
| 2. Extra Striping coat on edges, rivet heads and bolt heads and nuts | Formula No. 12-51 Tint  |
| 3. First Base Coat   | Formula No. 12-51 Tint  |
| 4. Crack Filler  | Formula No. A-3-57      |
| 5. Extra Striping coat on edges, rivet heads and bolt heads and nuts | Formula No. 12-51       |
| 6. Second Base Coat  | Formula No. 12-51 Tint  |
| 7. Third Base Coat   | Formula No. 12-51       |
| 8. First Finish Coat   | Formula No. 317-51 Tint |
| 9. Spot Coat (Field)   | All previous Coats      |
| 10. Final (Field) Finish Coat  | Formula No. 317-51      |

The number of coats and color on Span No. 15 is as follows:

- |  |                        |
|--|------------------------|
| 1. Prime Coat  | Formula No. 1          |
| 2. Extra Striping coat on edges, rivet heads and bolt heads and nuts | Formula No. 1 (tinted) |
| 3. First Base Coat   | Formula No. 2          |
| 4. Extra Striping coat on edges, rivet heads and bolt heads and nuts | Formula No. 1          |
| 5. Crack Filler  | Formula No. A-3-57     |
| 6. Second Base Coat  | Formula No. 3          |
| 7. Extra Striping coat on edges, rivet heads and bolt heads and nuts | Formula No. 1          |
| 8. Third Base Coat   | Formula No. 2          |
| 9. First Finish Coat   | Formula No. 4          |
| 10. Spot Coat (Field)  | All previous coats     |
| 11. Final (Field) Finish Coat  | Formula No. 5          |

Astoria Bridge

FORMULA No. 12-51-Red Lead-Quick Dry

FORMULATION AND SPECIFICATIONS:

Pigment:	Percent	Gallons	Pounds
Red Lead (97% Grade) . . . . .	85.0	11.10	822.00
Magnesium Silicate(Mil-M-15173)	10.0	4.18	96.68
Mica (ASTM D607). . . . .	4.5	1.86	43.50
Aluminum Stearate(Mil-A-15206 . . . . .	.5	.57	4.83
	100.00		
Vehicle:			
Resin (52-R-13a or 52-MC-501) . . . . .	69.00	54.40	426.42
Thinner (TT-T-291a) . . . . .	29.65	27.00	183.25
Lead Drier(TT-D-643) . . . . .	.85	.55	5.25
Cobalt Drier (TT-D-643) . . . . .	.25	.18	1.54
Manganese Drier (TT-D-643) . . . . .	.25	.18	1.54
	100.00	100.00	1,585.00

TT R 2402  
medium-oil

REQUIREMENTS:

Pigment	61.0% ±	2
Vehicle	39.0% ±	2
Nonvolatile Vehicle	48.0% ±	2
Weight Per Gallon	15.8 ±	.3 lbs.
Viscosity	75 ±	4 K U
Fineness	4	

Pigment Analysis:

Pb <sub>3</sub> O <sub>4</sub>	82%
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## Astoria Bridge

### FORMULA A-3-57 - Red Lead Sealing Paste

Red Lead (Dry pigment)	84.0%
Metallic Lead Paste	8.0%
Raw Linseed Oil	7.9%
Liquid Drier	0.1%
Weight Per Gallon (Minimum)	41.0 Pounds
Drying Time - Surface Dry for Recoating	24 hours

### FORMULA No. 317-51 - Green Finish

#### FORMULATION AND SPECIFICATIONS:

Pigment:		Percent	Gallons	Pounds
Chrome Green				
Oxide	(ASTM D263) . . . . .	56.0	3.8	162.4
Titanium	(TT-T-425) . . . . .	30.0	2.45	87.0
	(Type IIIC)			
Zinc				
Chromate	(TT-Z-415) . . . . .	13.6	1.37	39.4
	(Type II)			
Aluminum				
Stearate	(Mil-A-15206) . . . . .	.4	.14	1.2
		100.0		
Vehicle:				
Resin	(52-R-13a or 52-MC-501). . . . .	79.5	71.4	564.5
Thinner	(TT-T-291a) . . . . .	19.0	19.8	135.0
Lead Drier	(TT-D-643). . . . .	1.2	.88	8.5
Cobalt				
Drier	(TT-D-643). . . . .	.15	.12	1.0
Manganese				
Drier	(TT-D-643) . . . . .	.15	.12	1.0
		100.0	100.0	1,000.0

## Astoria Bridge

### REQUIREMENTS:

Pigment	29.0%	+ 2
Vehicle	71.0%	+ 2
Nonvolatile Vehicle	55.5%	+ 2
Weight Per Gallon	10.0	+ .3 lbs.
Viscosity	75	+ 4 K U
Fineness	6	

Color shall match the Standard Color Chip.

Cr <sub>2</sub> O <sub>3</sub>	54.0%
CrO <sub>3</sub>	5.5%
ZnO	4.7%
TiO <sub>2</sub>	28.0%

### FORMULA NO. 1 FORMULATION AND SPECIFICATIONS

Pigment:	Percent	Gallons	Pounds
Basic Lead Silico Chromate (ASTM D1648)	93.57	23.46	800
Red Iron Oxide (85% Fe <sub>2</sub> O <sub>3</sub> ) - Siliceous Type	5.85	1.35	50
Bentone 38 (National Lead Company)	0.58	0.33	5
	100.00		

Vehicle:			
Resin Solution (TT-R-266a, Type III)	52.42	42.0	319
Linseed Oil (TT-L-215)	26.78	21.0	163
Thinner (TT-T-291a, Grade I)	18.65	17.33	113.5
Zirconium Catalyst	1.20	1.01	7.3
6% Cobalt Naphthenate (TT-D-643)	0.18	0.13	1.1
6% Manganese Naphthenate (TT-D-643)	0.36	0.27	2.2
Anti-skimming Agent	0.16	0.13	1.0
Methanol-Water 95:5	0.25	0.22	1.5
	100.00	107.23	1,463.6

## Astoria Bridge

### REQUIREMENTS

Pigment	59.0% $\pm$ 1
Vehicle	41.0% $\pm$ 1
Nonvolatile Vehicle	52.0% $\pm$ 1
Weight per Gallon	13.5 lbs. min.
Viscosity	76 $\pm$ 4 K U
Fineness	4

#### Pigment Analysis:

Basic Lead Silico Chromate	93.2% Min.
Iron Oxide ( $\text{Fe}_2\text{O}_3$ )	5.3% $\pm$ 0.5

### FORMULA NO. 2

#### FORMULATION AND SPECIFICATIONS:

Pigment:	Percent	Gallons	Pounds
Basic Lead Silico Chromate (ASTM D1648)	93.2	23.46	800
Red Iron Oxide (85% $\text{Fe}_2\text{O}_3$ )-Siliceous Type	5.8	1.35	50
Lampblack	0.4	0.22	3
Bentone 38 (National Lead Company)	0.6	0.33	5
	100.0		
Vehicle:			
Resin Solution (TR-P-266a, Type III)	52.42	42.0	319
Linseed Oil (TR-L-215)	26.78	21.0	163
Thinner (TR-T-291a, Grade I)	18.65	17.33	113.5
Zirconium Catalyst	1.20	1.01	7.3
6% Cobalt Naphthenate (TR-D-643)	0.18	0.13	1.1
6% Manganese Naphthenate (TR-D-643)	0.36	0.27	2.2
Anti-Skinning Agent	0.16	0.13	1.0
Methanol-Water 95:5	0.25	0.22	1.5
	100.00	107.45	1,466.6

## Astoria Bridge

### REQUIREMENTS:

Pigment	59.0% $\pm 1$
Vehicle	41.0% $\pm 1$
Nonvolatile Vehicle	52.0% $\pm 1$
Weight per Gallon	13.5 lbs. min.
Viscosity	76 $\pm 4$ K U
Fineness	4

### Pigment Analysis:

Basic Lead Silico Chromate	93.2% min.
Iron Oxide ( $\text{Fe}_2\text{O}_3$ )	5.3% $\pm 0.5$

### FORMULATION AND SPECIFICATIONS:

#### FORMULA NO. 3

Pigment:	Percent	Gallons	Pounds
Basic Lead Silico Chromate (ASTM D1648)	93.57	23.46	800
Red Iron Oxide (85% $\text{Fe}_2\text{O}_3$ ) - Siliceous Type	4.68	1.08	40
Lampblack	1.17	0.67	10
Bentone 38 (National Lead Co.)	0.58	0.33	5
	100.00		
Vehicle:			
Resin Solution (TT-R-266a, Type III)	52.42	42.0	319
Linseed Oil (TT-L-215)	26.78	21.0	163
Thinner (TT-T-291a, Grade I)	18.65	17.33	113.5
Zirconium Catalyst	1.20	1.01	7.3
6% Cobalt Naphthenate (TT-D 643)	0.18	0.13	1.1
6% Manganese Naphthenate (TT-D 643)	0.36	0.27	2.2
Anti-skinning Agent	0.16	0.13	1.0
Methanol-Water 95:5	0.25	0.22	1
	100.00	107.63	1,463.6

### REQUIREMENTS:

Pigment	59.0% $\pm 1$
Vehicle	41.0% $\pm 1$
Nonvolatile Vehicle	52.0% $\pm 1$
Weight per Gallon	13.5 lbs. min.
Fineness	4
Viscosity	76 $\pm 4$ K U

### Pigment Analysis:

Basic Lead Silico Chromate	93.2% min.
Iron Oxide ( $\text{Fe}_2\text{O}_3$ )	4.4% $\pm 0.5$

## Astoria Bridge

### FORMULATION AND SPECIFICATIONS:

#### FORMULA NO. 4

##### Pigment:

	Percent	Gallons	Pounds
Basic Lead Silico Chromate (ASTM-D1648)	39.14	3.23	110
Titanium Dioxide, Rutile Non-Chalking (ASTM D476, Type II, Class II)	28.47	2.28	80
Chromium Oxide Green (ASTM D263)	21.35	1.39	60
Chrome Yellow Lemon (ASTM D211, Type II)	7.12	0.47	20
Phthalocyanine Green	1.07	0.17	3
Lampblack	1.78	0.34	5
Bentone 38 (National Lead Company)	1.07	0.20	3
	100.00		

##### Vehicle:

	Percent	Gallons	Pounds
Resin Solution (TT-R-266a, Type I)	71.6	64.0	512
Thinner (TT-T-291a, Grade I)	26.0	28.0	185.8
Zirconium Catalyst	1.2	1.2	8.9
6% Cobalt Naphthenate	0.5	0.5	3.6
4% Calcium Naphthenate	0.3	0.2	1.8
Anti-skinning Agent	0.3	0.26	2.0
Methanol-Water 95:5	0.1	0.13	0.9
	100.0	102.37	996.0

##### REQUIREMENTS:

Pigment	29.0% $\pm$ 1
Vehicle	71.0% $\pm$ 1
Nonvolatile Vehicle	50.0% $\pm$ 1
Weight per Gallon	9.6 lbs. min.
Viscosity	68-75 K U.
Fineness	5

#### FORMULA NO. 5

### FORMULATION AND SPECIFICATIONS

##### Pigment:

	Percent	Gallons	Pounds
Basic Lead Silico Chromate (ASTM D1648)	39.9	3.23	110
Titanium Dioxide, Rutile Non-Chalking (ASTM D476, Type II, Class II)	29.0	2.28	80
Chromium Oxide Green (ASTM D263)	21.7	1.39	60
Chrome Yellow Lemon (ASTM D211, Type II)	7.2	0.47	20
Phthalocyanine Green	1.1	0.17	3
Bentone 38 (National Lead Company)	1.1	0.20	3
	100.0		



## Astoria Bridge

### Vehicle:

	Percent	Gallons	Pounds
Resin Solution (TT-R-266a, Type I)	71.6	64.0	512
Thinner (TT-T-291a, Grade I)	26.0	28.0	185.8
Zirconium Catalyst	1.2	1.2	8.9
6% Cobalt Naphthenate	0.5	0.5	3.6
4% Calcium Naphthenate	0.3	0.2	1.8
Anti-Skinning Agent	0.3	0.26	2.0
Methanol Water 95:5	0.1	0.13	0.9
	<hr/> 100.0	<hr/> 102.03	<hr/> 991.0

### REQUIREMENTS:

Pigment	28.0% $\pm$ 1
Vehicle	72.0% $\pm$ 1
Nonvolatile Vehicle	50.0% $\pm$ 1
Weight per Gallon	9.6 lbs. min.
Viscosity	68-75 K U
Fineness	5

Thomas Creek BridgeMAINTENANCE PAINTING

Scope - Cleaning and painting of structural steel shall be performed in conformance with the following provisions. The system used is organic zinc - vinyl coating system.

Materials - All materials in the paint system shall conform to the following:

1. Organic zinc - Organic zinc shall be either (1) or (2) component conforming to the following:

(1-a) Examples are:

California Specification 701-80-62  
Carboline 655 or 676  
Mobilzinc 2  
Catha Coat 302  
Amercoat #62  
Mil-P-21035 or Accepted Equal

(1-b) It shall contain a minimum of 85% zinc in the dry film.

(1-c) If two component, it must be packaged so that one unit of the pigment can be mixed with the vehicle in its container. The containers shall be coated if necessary to prevent attack by the mixed paint.

(1-d) Complete instructions for use shall be included with each container.

2. Vinyl wash primer - Shall conform to requirements of Mil-<sup>P</sup>15328C(Blue) Coating, Pretreatment (Formula 117).

(2-a) It shall be mixed by adding (1) volume of acid component to (4) volumes of resin components slowly with constant stirring. Mixed material must be used within 8 hours.

(2-b) Mixed material may be thinned with n-Butanol or 99% Isopropanol.

3. Vinyl finish coat - Vinyl finish coat shall conform to the following:

Thomas Creek Bridge

- (3-a) The vehicle shall consist of polyvinyl chloride acetate copolymer resins with chemically inert plasticizers plus suitable solvents. The vinyl coat shall display compatibility with the vinyl wash primer when applied in accordance with manufacturer's printed Application Instructions of latest date.
- (3-b) The vinyl finish coat shall be supplied in a single package.
- (3-c) The vinyl finish coat shall contain not less than 28 percent solids by volume. Weight per gallon shall be a minimum of 9.4 pounds at 77°F.
- (3-d) The vinyl finish coat shall air dry at temperatures of 70°F or above to a hard tough film within 4 hours, entirely by evaporation of solvents. It shall be dry to touch in about 20 minutes at 70°F.
- (3-e) The vinyl finish coat shall form a system fully resistant to salt air, fog, high humidity, condensation, rainfall and temperature extremes.

4. Compatibility of materials - Prior to starting any painting work, the contractor shall furnish to the engineer a certificate from the manufacturers of the materials certifying that these products are compatible one to the other and with the existing paint to remain in place. The contractor will also be required to demonstrate to the engineer that the organic zinc, vinyl wash primer and topcoat materials to be used on the project are compatible, one with the other, prior to starting any painting work.

near

Cleaning - Structural steel shall be cleaned to white metal. The appearance of the surface after cleaning shall be in reasonably close conformity to the pictorial standard Sa2-1/2 of ASTM 2200.

Cleaning shall be by blast cleaning with final cleaning to be by brushing with clean brush of hair, bristles or fiber, and blown off with compressed air (from which detrimental oil and water have been removed) or cleaned by vacuum.

Blast cleaning shall be performed by a dry sandblasting method using sand of a size which will result in a profile, after blasting, in conformance with the recommendations of the manufacturer of the organic zinc.

Power tool cleaning shall be used if necessary to obtain a rust-free surface. Areas power tool cleaned shall be sandblasted to obtain a white metal finish with the proper anchor profile.

## Thomas Creek Bridge

Any traces of oil, grease or smudge resulting from blast cleaning shall be removed by wiping with rags wetted by clean solvent.

Color and Number of Coats - The final coat shall match the color of OSHD formula 317-74. Where necessary paint shall be shaded off color sufficiently to permit detection of incomplete application.

The paint shall be applied in coats as follows:

1. Base coat organic zinc.
2. Striping coat organic zinc on edges, rivet heads, boltheads and nuts.
3. Vinyl wash primer.
4. First vinyl coat.
5. Second vinyl coat.

The striping coat shall extend at least one inch from edges where practicable.

### Application:

Organic Zinc - During the same working day as sandblast cleaning is completed, organic zinc shall be applied, in one or two coats, to the cleaned surface. The organic zinc coatings shall be applied by spraying. The base coat of organic zinc shall yield a minimum dry film thickness of three mils above the blast profile ridges.

If any rust has formed or any salt spray has been deposited on the cleaned metal before the organic zinc is applied, the steel shall be reblasted prior to application of the organic zinc.

Equipment used in application of the organic zinc coating shall be in conformance with the recommendation of the manufacturer of the material and must also constantly stir the paint.

Organic Zinc - The organic zinc stripe coat shall be applied in accordance with the manufacturer's recommendations and shall yield a minimum dry film thickness of three mils.

Vinyl Wash Primer - A coat of vinyl wash primer shall be applied by spray at a rate which will give a dry film thickness of from 0.3 to 0.5 mils.

Vinyl Finish Coat - The vinyl finish coat shall be spray applied in two or more coats, in conformance with the manufacturer's recommendations and at a rate which will yield a minimum dry film thickness of five mils. Care shall be taken to completely coat all edges, cracks, crevices, rivets and other surface irregularities.

## Thomas Creek Bridge

Spray equipment used in application shall be in conformance with the recommendation of the manufacturer of the vinyl coating.

If contamination from salt spray or other causes occurs after the application of any of the above coats, the contractor shall steam clean the contaminated coat before the application of the succeeding coat.

### General Requirement:

Unless otherwise specifically authorized by the engineer, the application of the organic zinc coating, the vinyl wash coat or the vinyl finish coat will not be permitted:

(a) When the temperature of the coating material, the temperature of the steel or the ambient temperature is below 40°F.

(b) When the ambient temperature is less than 5°F above the dew point temperature.

(c) When the relative humidity is above 80%.

The bidders on this project are advised that, during the life of the contract, there will be a considerable amount of time when the above-specified weather conditions will not prevail and it shall be understood that the bidder, prior to submitting his bid, has considered the weather conditions that will be encountered at the site of the work during the life of the contract.

All work to be performed under the contract shall be performed in conformance with the best practices of the trade, in conformance with the recommendations of the coating manufacturer's recommendation, and in conformance with the applicable specifications set forth in the Steel Structures Painting Council's specification SSPC-PA 1-64, when those specifications are not in conflict with these special provisions.

At joints between paint to remain in place and the new coatings, the contractor will be required to use a tie coat compatible to the existing paint to obtain a joint satisfactory to the engineer. Overlaps between the new paint system and existing paint to remain shall be kept to a practical minimum.

The contractor shall remove all paint spots, sand and debris from all areas of the structure on which no cleaning and painting are to be performed and are a result of cleaning and painting under this contract. This shall be understood to include removal of sand and debris from all box sections. All cleanup work shall be performed in a manner approved by the engineer.

Thomas Creek Bridge

Testing of Film Thickness:

In order to insure the proper thickness of the coatings applied to exterior surfaces, gauge readings using single probe spring loaded Microtest gauge or Elcometer gauge shall be taken in accordance with the following procedure:

(a) Ninety percent of all readings shall be within the specified dry film thickness, and 100% of all readings shall be within 0.5 mil of the specified dry film thickness.

(b) Where thickness readings in accordance with the above procedure fall below the specified minimum, an additional application shall be applied.

PAYMENT

514.81 and 514.91 Measurement and Payment - Payment for cleaning and painting work as specified will be made on the basis of the lump sum amount for the item:

1. Clean and Paint Thomas Creek Bridge

Payment for the above item shall be understood to be full and complete payment for furnishing all labor, materials, tools, equipment, supplies and for other costs required to complete the work as specified except partial payment for flagmen will be made as hereinbefore set forth.

## POTASSIUM SILICATE ZINC DUST COATING

### TECHNICAL SUPPORT PACKAGE FOR NASA TECH BRIEF 70-10600

The newly developed inorganic paint for metals described herein has overcome most of the major problems encountered with conventional coatings for metal surfaces: low adhesion, tendency to develop cracking and crazing during drying, and flammability. The basic paint consists of a suspension of zinc oxide in a potassium silicate vehicle, with a small amount of methyltrimethoxysilane added. Compatible fillers and dyes may also be added.

In addition to a technical description of this inorganic metal coating, this support package includes a bibliography of related NASA publications.

The information in this Technical Support Package comprises the documentation announced in NASA Tech Brief 70-10600, and is provided under the Technology Utilization Program of the National Aeronautics and Space Administration to make available the results of aerospace-related developments considered to have wider technological, scientific or commercial applications. This invention derives from the Technology Utilization Program managed by Goddard Space Flight Center. The research was carried out by John B. Schlutt of Goddard Space Flight Center.

Additional information regarding inorganic coatings may be found in Scientific and Technical Aerospace Reports (STAR) which is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. STAR is available to the public on subscription from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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ENGINEERING

### POTASSIUM SILICATE ZINC DUST COATING

This information relates to improvements in coating compositions utilized to form protection for metals, preferably steel, and other surfaces. The coating compositions contain ~~zinc dust~~ carried in a silicate vehicle such as potassium silicate solution. The ratio of silica to potassium oxide is critically controlled.

The desirability of utilizing zinc dust in formulations for metal coatings has led to the development of numerous vehicle systems, each intended to solve numerous problems encountered when attempting to adhere such a material to the base metal. The problem of uniform adherence both before and after baking is consistently serious, but other problems such as cracking, crazing, weather wearing and fire resistance are also usually encountered. The last of these problems may be solved completely only by using inorganic vehicles; however, since inorganic coatings are notoriously poor in finish characteristics, their use further complicates the problem.

Numerous inorganic materials have been used in the past which claim to have solved most of the problems involved in metal coatings. Generally, the solution is stated to lie in utilizing an alkali metal silicate solution vehicle. Specific formulations proposed the use of sodium silicate or potassium silicate in such solutions wherein the mole ratio of sodium oxide ( $\text{Na}_2\text{O}$ ) or potassium oxide ( $\text{K}_2\text{O}$ ) to silica ( $\text{SiO}_2$ ) is greater than the normal 1:2, preferably being between 1:2.3 and 1:3.0. However, even with these modifications in component ratios, the techniques required that additive components be incorporated into the composition to provide or enhance the requisite properties. These additives include such materials as lead chromate, which is intended to render the coating insoluble, or ammonia, or a fatty acid for spreadability and adhesion. Further suggestions include overcoatings with acids to insure neutralization, particularly when corrosive environments are encountered.

In actual practice, these proposals, among others, have not proved totally satisfactory. The principal problem has been that each time a new material is added to solve one problem, other problems are potentiated.



A zinc dust vehicle has been developed which is predominantly one material and which, when dried and/or baked, is not subject to problems of cracking or crazing. It is fire retardant while maintaining excellent adherence even when subjected to weathering or corrosive environments.

Potassium silicate has proved to be effective as a binder in zinc dust formulations: its solution serves as an excellent vehicle for the zinc dust provided the mole ratios of silica to potassium oxide are maintained at a high level, preferably at the range of 4.8:1 to 5.3:1. These ranges far exceed normal commercial ratios which peak at about 3.3:1 and which are totally ineffective for the above purposes. The preferred ratios of silica to potassium oxide are essential to the development of a satisfactory coating; ratios less than those noted provide a coating subject to cracking and crazing upon heat application or air aging. Ratios higher than those noted are possible, but do not provide improved results because the ratios appear dependent upon complete hydration of the silica in solution, and additional silica obviously will be in such condition due to the minimized potassium oxide. The coating composition is generally prepared utilizing a solution containing 19 to 23 parts by weight potassium silicate. This solution may be designated 19-23K 4.8-5.3; the 19-23 representing the % solids in solution; the 4.8-5.3 representing the mole ratio of silica to potassium oxide; and K representing the potassium silicate.

Zinc dust is the other requisite compound of the composition and may be present in a broad range of amount based on the potassium silicate solution of from about 1 to 6 times the % by weight of the latter (6-27 times the % by weight silicate solids). The particular size particles of zinc dust also are not critical, although it is preferred to utilize particles smaller than 50 microns, and more preferably smaller than 3 microns.

To this basic mixture, lower alkyl lower alkoxy silane, preferably methyltrimethoxysilane, may be added in amounts up to 3% by weight based on the total mixture in order to provide better adherence to steel substances due to more uniform dehydration. The lower alkyl groups may contain up to 8 carbon atoms, but as indicated, the methyl is preferred due to its relatively lower expense and ease of availability.

The composition may also contain compatible fillers and dyes for standard extension and identification; the only criteria for addition of these components are that they do not affect the required characteristics.

### EXAMPLE III

Component	Parts by Weight	% by Weight
Potassium silicate sol. 20K4.8	64.5	21.2
Zinc dust	$\frac{240.0}{304.5}$	$\frac{78.8}{100.0}$

### EXAMPLE IV

Potassium silicate sol. 22K4.8	64.5	21.2
Methyltrimethoxysilane	2.0	0.6
Zinc dust	$\frac{240.0}{306.5}$	$\frac{78.2}{100.0}$

### EXAMPLE V

Potassium silicate sol. 20K5.3	64.5	21.2
Zinc dust	$\frac{240.0}{304.5}$	$\frac{78.8}{100.0}$

### EXAMPLE VI

Potassium silicate sol. 19K5.3	64.5	17.6
Zinc dust	300.0	82.0
Methyltrimethoxysilane	$\frac{2.0}{366.5}$	$\frac{0.4}{100.0}$

Each of the above formulations was sprayed on steel surface, air dried at ambient temperature for 4 hours and visually and microscopically examined. In each case a firm adherent film was produced. The compositions containing the methyltrimethoxysilane appeared slightly more adherent when subjected to scraping tests and evidenced a more glossy finish.

The substrates to which these compositions are applied are generally metallic. Steel is of prime importance as the base to be treated. In such applications, the steel is first subjected to cleaning with phosphoric acid or sand blasting. The coating may be applied by all conventional techniques, spraying being preferred for obtaining a uniform application.

Having described the general details, the following table summarizes the preferred formulations:

Component	Range - % by Weight
Potassium silicate sol. 19-23K4.8-5.3	17.6-41
Methyltrimethoxysilane	0.0-3
Zinc dust	56.0-82

The following are specific formulations:

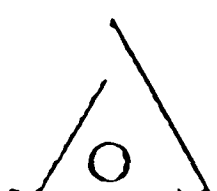
#### EXAMPLE I

Component	Parts by Weight	% by Weight
Potassium silicate sol. 20K5.3	64.5	21.0
Methyltrimethoxysilane	2.0	.6
Zinc dust	240.0 306.5	78.4 100.0

(After 4 hours air drying, the coating was assayed at 94.4% Zn + silicone)

#### EXAMPLE II

Potassium silicate sol. 22K4.8	64.5	26
Zinc dust	180.0 244.5	74 100

  
ARTECH CORP. 2901 Telestar Court Falls Church, Virginia 22042 (703) 560-3292

September 19, 1979

Mr. Merle Bukler, Supervisor  
Office of Materials and Testing  
Dept. of Transportation  
Pierre, South Dakota 75701

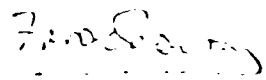
Dear Sir:

We are compiling for the Navy a comparison of all the specifications now in use or proposed for zinc-rich paints or primers (both the inorganic and organic types). If you have such a specification, we should very much like to obtain a copy. If you employ a specification issued by a national organization, such as the Steel Structures Painting Council, a reference to their designation would also be appreciated. The information should be addressed for my attention - a return envelope is enclosed.

We are grateful for your cooperation. The results will benefit our Navy and ultimately will help to improve the quality and economy of the nation's rust-protection technology.

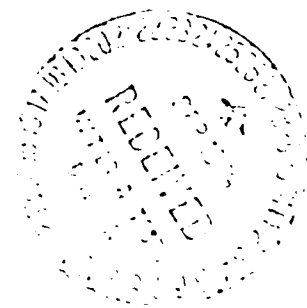
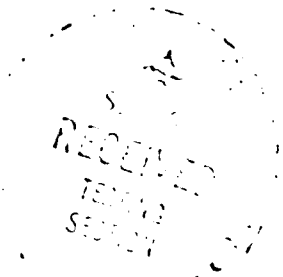
Sincerely yours,

ARTECH CORP.

  
Fred Ordway  
Executive Vice President

*400 Specifications  
for Zinc-rich paints*

FO/jb



MAY 26, 1977

This specification covers a 2-component self-curing ethyl silicate vehicle type zinc silicate paint which, when mixed and applied in accordance with the attached special provisions for Section 414A, shall cure without the use of a separate curing solution and will meet service requirements for highway construction.

## II. COMPOSITION -

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The zinc portion shall be of a finely divided zinc powder containing a minimum of 94 percent metallic zinc and 93 percent total zinc by weight. There shall be a minimum of 14½ pounds of zinc to 1 gallon of the mixed paint.

The ethyl silicate used in the hydrolysis reaction in the preparation of the vehicle shall contain at least 25 percent silicon dioxide.

Pigment, percent by weight, minimum	11.0
Nonvolatile at 165° C percent by weight, minimum	30
SiO <sub>2</sub> , percent by weight after pigment, removal minimum	11.0
Storage life of vehicle at 70° F, month, minimum	18
Weight per gallon, pounds, at 70° F, minimum	8.3

Weight per gallon, pounds	20.5 - 22.5
Viscosity, K.U. at 77°F., maximum	70 - 90
Konvolatile at 105°C percent by weight	79.5 - 89.5
Set to touch, minutes, maximum	- 10
Dry hard, hours, maximum	24
Pot life at 77°F., minimum, hours	8

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#### NO. 4 PAINT--INORGANIC ZINC SILICATE (Cont.)

Working properties shall be satisfactory at all temperatures and conditions under which the paint is applied to produce a satisfactory sprayable coating.

#### III. RESISTANCE -

Test panels shall be cleaned to meet Steel Structures Painting Council Specification, SSPC-SP10-63. A three mil. coating (dry thickness) shall then be applied to test panels. Each of the following tests shall be performed on one or more test panels. If any individual test panel fails any of the following tests, the material will not be accepted.

##### (a) Fresh Water Resistance :

Panels shall be scribed down to base metal with an X of at least 2 inch legs and shall be immersed in fresh tap water at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening when examined after 30 days.

##### (b) Salt Water Resistance:

Panels shall be scribed down to the base metal with an X of at least 2 inch legs and immersed in 5 percent sodium chloride at  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ . The panels shall show no rusting, blistering or softening upon examination after 7, 14, and 30 days. The sodium chloride solution shall be replaced with fresh solution after each examination.

##### (c) Resistance to Elevated Temperatures and Thermal Shock:

Panels shall be exposed to a temperature of  $500^{\circ}\text{F}$  for one hour, then quenched immediately in  $65^{\circ}\text{F} \pm 5^{\circ}\text{F}$  water. Panels subjected to this test shall show no blistering or flaking of the coating.

#### IV. PACKING AND LABELING -

Inorganic zinc paint shall be packaged in two-compartment containers or in two separate containers. The components shall be packaged in such proportions that the pigment mixed with the vehicle will yield 5 gallons of mixed paint. Each container shall bear a label on which shall be clearly shown the name of the manufacturer or brand name of paint, the lot number, date of manufacture and individual net weights of pigment and vehicle. The label on the vehicle container shall also include complete instructions for use of this paint. The container shall be coated if necessary to prevent attack by the paint components.

#### V. APPLICATION -

The manufacturer's current printed instructions for application of inorganic zinc coating shall be submitted to the Department for review. The supplier of the paint shall furnish the services of a technically qualified individual who is acceptable to the Engineer and the manufacturer of the paint and who shall be available for consultation at the fabricating shop at such times as the Engineer may designate.

#### VI. SAMPLING -

Initial samples for tests shall be submitted to the Department's Chemistry Laboratory AT LEAST 45 DAYS in advance of anticipated need so that the necessary physical tests may be performed.

Washington State Highway Commission  
DEPARTMENT OF HIGHWAYS  
OLYMPIA, WASHINGTON

NOV. 2 1979

*Reprints from*  
WASHINGTON  
1977 STANDARD  
SPECIFICATIONS

Sec. 9 08	PAINTS .....	593-607
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Sec. 9 23	CONCRETE CURVING MATERIALS AND ADMIXTURES .....	685-688
Sec. 9 26	EPOXY RESINS .....	691-695

Paints

Formula A-4-59—Phenolic-Red Lead Primer.

The primer shall meet the requirements of Federal Specification TT-P-615, Type IV, Paint, Red Lead Base, Ready Mixed. The viscosity of the mixed paint shall be 80-90 K.U. at 70° F. and the Sag Index shall be 6 minimum.

Formula A-5-61—Vinyl Pretreatment.

The primer shall meet the requirements of Federal Specification TT-P-615, Primer Pretreatment, Formula 17B for Metals.

Formula A-6-61—Zinc Dust Zinc Oxide Primer.

The primer shall meet the requirements of Federal Specification TT-P-615, Primer—Paint, Zinc Dust-Zinc Oxide, Type II, or Type III, except that the viscosity shall be 80-90 K.U. at 70° F. and the Sag Index shall be 6 minimum.

Formula A-7-70—Shop Coat for Steel (Basic Lead Silico Chromate).

This paint shall generally conform to Federal Specification TT-P-615, Type IV, Shop Coat for Steel, except that the characteristics of the paint shall be as follows:

Viscosity	80-90 K.U.
Weight per gallon (minimum)	13.4 pounds
Time to dry (hours)	4
Time to dry (hours) (maximum)	16 hours
Time to dry (hours) (minimum)	6
Time to dry (hours) (maximum)	6

Formula A-8-72—Shop Coat for Steel (Basic Lead Silico-Chromate).

This paint shall generally conform to Federal Specification TT-P-615, Type IV, Shop Coat for Steel, except that the characteristics of the paint shall be as follows:

Viscosity	80-90 K.U.
Weight per gallon (minimum)	13.2 pounds
Time to dry (hours)	4
Time to dry (hours) (maximum)	6 hours
Time to dry (hours) (minimum)	6
Time to dry (hours) (maximum)	6

Paints

Formula A-9-73 Galvanizing Repair Paint, High Zinc Dust Content.

The galvanizing repair paint shall meet the requirements of Federal Specification TT-P-21035 (Ship's Paint, High Zinc Dust Content, Galvanizing Repair).

Formula B-4-59—Phenolic First Field Coat for Steel.

The phenolic first field coat for steel shall meet the requirements of Federal Specification TT-P-86, Type IV—Paint: Red-Lead-Base Ready Mixed—except that 0.4% of the red lead content shall be replaced with lampblack to give a resultant brown color. The viscosity of the finished paint shall be 80-90 K.U. and the Sag Index shall be 6 minimum.

Formula B-7-70—First Field Coat for Steel (Basic Lead Silico Chromate).

This paint shall generally conform to Federal Specification TT-P-615, Type II.

Five pounds per 100 gallons (approximately 0.5 percent of the total formula weight) of the red iron oxide called for in Formula A-7-70 shall be replaced with lampblack to yield a brown color.

Other than color, the characteristics of the B-7-70 shall be the same as listed for A-7-70.

Formula B-8-72—First Field Coat for Steel (Basic Lead Silico-Chromate).

This paint shall generally conform to Federal Specification TT-P-615, Type IV.

Five pounds per 100 gallons (approximately 0.4 percent of the total formula weight) of the red iron oxide called for in formula A-8-72 shall be replaced with lampblack to yield a brown color.

Other than color, the characteristics of B-8-72 shall be the same as listed for A-8-72.

Formula C-6-59—Green Phenolic Finish Coat for Steel.

Zinc chromate (dry pigment)	13.8 parts
Chromium green oxide (dry pigment)	16.1 parts
Titanium dioxide (dry pigment)	16.7 parts
Yellow iron oxide (dry pigment)	1.3 parts



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# Paints

Titanium dioxide (dry pigment)	5.0 parts
Aluminum silicate (dry pigment)	0.2 parts
Zinc oxide	22.1 parts
Aluminum silicate	21.4 parts
Aluminum silicate	1.0 parts
Aluminum silicate	0.1 parts
Aluminum silicate	2.3 parts
Weight per gallon (minimum)	12.5 pounds
Viscosity at 70° F.	80-90 K.U.
Set to touch	6
Dry hard	4 hours
Sag Index	18 hours
	7 Min.

Test Requirements: Prior to manufacture, Viscosity Adjustment: Mineral spirits to be added at the factory to achieve the specified viscosity.

The proportions of tinting pigments may be varied to achieve the desired color. The color of the paint when dry must match the color of a standard C-5 color chip. Additional tinting pigments may be required.

## Formula C-9-71—Steel Gray Phenolic Finish Coat for Steel (Pluchere G-148).

Zinc Oxide (dry pigment)	21.0 parts
Titanium Dioxide (dry pigment)	21.0 parts
Aluminum silicate (dry pigment)	5.0 parts
Aluminum silicate	5.9 parts
Aluminum silicate	0.2 parts
Aluminum silicate	14.5 parts
Aluminum silicate	29.0 parts
Aluminum silicate	0.1 parts
Aluminum silicate	1.0 parts
Aluminum silicate	2.1 parts
Aluminum silicate	13.0 lbs.
Aluminum silicate	80-95 K.U.
Aluminum silicate	18 hours
Aluminum silicate	4 hours
Aluminum silicate	5
Aluminum silicate	7

Test Requirements: Prior to manufacture, Viscosity Adjustment: Mineral spirits and talc, solvents and chemical additives shall be made at the factory to achieve the desired color and physical characteristics.

Color: Finished paint must match Pluchere G-148 color (color sample available from the Material's Laboratory).

# Paints

9-08

## Formula D-1-57—Aluminum Paint.

Aluminum paste Type 2 Class B	2.0 pounds
Spar varnish	1.0 gallon

Aluminum paint shall be mixed on the job site, and only enough for one day shall be mixed at a time. The weighed amount of paste shall be placed in a suitable mixing container and the measured volume of vehicle then poured over it. The paste shall be incorporated by vigorous stirring with a paddle.

Test Requirements: Prior to mixing.

## Formula D-4-57—Black Enamel.

The enamel shall meet the requirements of Federal TT-E-529 Black Enamel, Synthetic, Semi Gloss.

Test Requirements: This enamel will be sampled and tested in the ready-mixed form.

## Formula D-5-57—White Guard Rail Paint (Alkyd Vehicle).

Titanium dioxide (dry pigment)	28.1 parts
Zinc oxide (dry pigment)	10.9 parts
Fibrous magnesium silicate (dry pigment)	4.3 parts
Aluminum silicate (dry pigment)	0.5 parts
Alkyd vehicle	37.0 parts
24% lead naphthenate drier	0.4 parts
6% Cobalt naphthenate drier	0.2 parts
6% Manganese naphthenate drier	0.2 parts
Anti-skimming agent	0.2 parts
Mineral spirits	18.2 parts
Weight per gallon (minimum)	11.0 pounds
Viscosity at 70° F.	80-90 K.U.
Nonvolatile content (minimum)	70.2%
Grind (minimum)	4
Fluid power (maximum scale reading)	30
Set to touch	4 hours
Dry hard	18 hours
Sag Index	7 Min.

Test Requirements: Prior to manufacture, Viscosity Adjustment: Mineral spirits will be added at the factory to achieve the specified viscosity.

This formula is to be used over primed or previously painted surfaces.

9-08

## Paints

### Formula E-1-57—White for Wood Structures.

The material shall conform to Federal TT-P-102, Class A. Test Requirements: This paint will be sampled and tested in the ready-mixed form.

Primer: Turpentine may be added to the above paint in quantities not to exceed 1 1/2 pints per gallon of paint for use as a primer.

### Formula E-2-62—Primer for Wood.

The primer shall be a ready mixed priming paint for use over untreated wood surfaces. It shall meet the requirements of Federal Specification TT-P-25 Primer, Paint, Exterior.

Test Requirements: This paint shall be sampled and tested in the ready-mixed form.

### Formula F-3-64—Orange Equipment Enamel.

The enamel shall meet the requirements for Enamel, Alkyd, Gloss, Federal Specification TT-E-489, except that the Sag Index shall be 7 minimum. The color, when dry, shall match that of Federal Standard No. 595, Color 12246.

Test Requirements: When manufactured on Contract or Purchase Order for maintenance use, the enamel will be sampled and tested in the ready-mix form. No factory inspection will be required; however, a one-pint sample representing the batch must be submitted to the March's Laboratory for approval before use.

For factory application to individual items of new equipment, samples of the enamel will not be required; however, the equipment manufacturer must match the color and certify the quality of enamel used.

### Formula H-1-57—Primer for Concrete.

Titanium calcium pigment	24.7 parts
Portland magnesium silicate	6.8 parts
Silica	6.8 parts
Spirit varnish	52.3 parts
Water	9.4 parts
Weight per gallon (minimum)	9.8 pounds
Dry time (for testing purposes only)	18 hours
Viscosity at 70° F.	65-75 K U.

## Paints

9-08

Consistency: The paint shall not thicken after manufacture to an extent sufficient to impair its brushing qualities.

Test Requirements: Prior to manufacture.

### Formula H-2-62—White Masonry Paint for Precast Curbs.

Titanium dioxide (dry pigment)	11.9 parts
Calcium carbonate (dry pigment)	25.6 parts
Silica (dry pigment)	7.4 parts
Diatomaceous silica (dry pigment)	7.0 parts
Linseed (body agent)	0.5 parts
Phthalic 55-A	8.0 parts
Chlorinated Paraffin 40%	4.0 parts
Chlorinated Paraffin 70%	4.0 parts
Aromatic brushing thinner	31.6 parts
Viscosity at 70° F.	90-100 K U.
Weight per gallon (minimum)	12.1 pounds
Drying time (for test purposes only)	18 hours

Test Requirements: Prior to manufacture.

### Formulas J-1-68, J-2-68, J-3-68, J-6-68, J-7-68, J-8-68—Enamels for Signs.

Sign enamels are intended for application to wood, plywood, steel and aluminum surfaces, over a compatible primer. They shall be provided at a viscosity suitable for thinning for brush or spray application. The label shall state the thinner suitable for each purpose.

The enamels shall meet Federal Specification TT-E-489 "Enamel, Alkyd, Gloss." Colors for the various formula numbers are as follows:

J-1-68	White
J-2-68	Interstate Yellow
J-3-68	Black
J-6-68	Interstate Green
J-7-68	Interstate Blue
J-8-68	Interstate Red

### Formula J-4-57 Brilliant Green Sign Enamel.

This formula shall be a ready-mixed exterior paint meeting the requirements of Federal TT-P-71, except that a blend of titanium dioxide and tinting pigments shall be used instead of chrome green oxide. The paint shall match the color of a Standard Interstate Green. The paint, when reduced with an equal weight of linseed oil,

9-08

## Paints

Quantities of 20 gallons or less of the above formulas will be accepted without inspection upon the manufacturer's notarized certificate. This certificate shall contain a statement by the manufacturer to the effect that the material meets the formula specification, and shall include a list of materials and quantities used. One copy of the certificate shall accompany the paint when shipped and one copy with a sample of the paint shall be sent to the Materials Laboratory. The paint may be used at once without further release from the Materials Laboratory.

### 9-08.4 Process of Manufacture.

The following process of manufacture shall be used for each paint except aluminum paint. Pigments shall be ground thoroughly in appropriate portions of the specified vehicle to form a paste meeting the requirements set forth in Section 9-08.4(6) under "Fineness of Grinding." The grinding shall be done in a mill of a type approved by the Engineer. The use of the "colloid" type of mill will not be approved. Weighed quantities of the paste and weighed or measured quantities of the vehicles shall then be mixed thoroughly and strained, if necessary, to form a paint free from skins, lumps and foreign materials.

### 9-08.4(1) Viscosity Adjustment.

The volatile thinner content of the paint shall be adjusted at the factory to meet the required viscosity, but in no case shall the resultant weight per gallon and nonvolatile content of the paint be less than that specified in the formula.

### 9-08.4(2) Weight Variations.

The weight per gallon of the paint in any lot shall not be less than that stated in the formula. A "lot" as used in this section shall be the quantity of paint ground at one time by any one mill.

### 9-08.4(3) Drying Time and Quantity of Drier.

The paint shall dry within the length of time stated in each formula but shall not contain sufficient quantities of drier to cause the paint to dry to a nonuniform or nonelastic film. The manufacturer will be permitted to vary the quantity of drier given in the formula sufficiently to accomplish the above results.

### 9-08.4(4) Working Properties.

The paint shall contain no caked material that cannot be broken

## Paints

shall have a hiding power of not less than 750 square feet per gallon when measured on the Pfund Cryometer, Model E, white plate, viewed in a light of approximately 50 foot candle intensity.

### Exterior Acrylic Latex Paint-White.

This paint shall meet the requirements of Federal Specification TT-301, Paint, Acrylic Emulsion, Exterior, except that the viscosity shall be 75 BKU.

This paint may be used self-primed in multiple coats over salts treated wood and on interior and exterior masonry surfaces.

Test Requirements: This paint will be sampled and tested in the ready mixed form.

### Traffic Signal Yellow Enamel.

Traffic signal yellow enamel shall meet the provision of Federal Specification TT-3489—Enamel, Alkyd, Gloss—and shall match the color of Standard Interstate Yellow.

### 9-08.3 Inspection Requirements—General.

Paints are classified into those requiring sampling and testing of raw materials prior to manufacture of the paint with inspection during manufacture, and paints which will be accepted on tests of the completely manufactured product. The type of test procedure required is indicated with the requirements for each formula under the heading "Test Requirements."

When the expression "prior to manufacture" is used in connection with a given formula, the manufacturer shall notify the Engineer when sufficient quantities of the necessary raw materials are on hand at the factory. The Engineer will then sample and seal each lot of material of respect the manufacturer to do so, and the lots so sealed shall be reserved for use until the Engineer notifies the manufacturer of the acceptance of the lots sampled. The manufacturer shall certify that the paint was manufactured from the lots of raw materials so sampled.

The manufacturer shall notify the Engineer of the date on which manufacture will be started and the Engineer shall have the right to select all colors of the manufacturing process and to assure himself that none but accepted lots of raw materials are used. The term "raw materials" shall apply to each separate ingredient given in the formula except that various and single pigments ground to paste form in the specified vehicle shall be considered as "raw materials."

#### 9-08.4

#### Paints

on readily by stirring. When applied to a clean vertical surface the paint shall dry without running, streaking or sagging.

#### 9-08.4(5) Storage Properties.

Paints manufactured under these specifications shall show no skin over the surface after 48 hours in a partially filled container, when tested as outlined in Federal Test Method Standard No. 141. A skin amount of skin or gel formation where the surface of the paint is visible on the inside of the container may be disregarded. Variable percentages of "anti-skinning agents" are shown in those formulas set forth above that are susceptible to undesirable skin formation. The manufacturer will be allowed to vary the amount of "anti-skinning agent" shown in the formulas provided the above results are accomplished and it is known that the paint does not dry to a nonuniform or nonelastic skin.

#### 9-08.4(6) Fineness of Grinding.

The paint shall be ground so that all particles of pigment will be dispersed and be coated with vehicle, and the residue on a 325 sieve will not exceed 1 percent by weight of the pigment.

#### 9-08.4(7) Standard Colors.

When the paint is required to match a standard color, the manufacturer may obtain a sample of the required color without cost upon application to the Materials Laboratory, P.O. Box 167, Olympia, Washington 98504.

#### 9-08.4(8) Containers.

Each container shall be filled with paint and sealed airtight. Each container shall be filled with the amount of paint required to yield the specified quantity when measured at 70° F.

All paint shall be shipped in new suitable containers having a capacity not greater than 5 gallons. Each container shall be marked with a suitable number to identify the particular batch from which it was filled.

#### 9-08.5 Test Methods.

As set forth in Section 9-08.2, all paints shall meet the special requirements set forth for each formula. The test methods used to check these special requirements shall be as specified in the Washington State Highway Department Laboratory Manual, or the corresponding test method covered by Federal Specification 11-P-141.

#### Paints

9-08

When test methods are not covered by the above, applicable ASTM methods shall be followed.

#### 9-08.6 Shipping.

Except for lots of paint in quantities of 20 gallons or less which are accepted upon the manufacturer's certificate, the manufacturer shall not ship any lot of paint until the paint has been tested and/or released by the Washington State Department of Highways Materials Laboratory. This release will not constitute final acceptance of the paint. Final acceptance will be based on inspection or testing of job-site samples as determined by the Engineer.



OCT. 2 - 1979

WEST VIRGINIA DEPARTMENT OF HIGHWAYS

JOHN D. ROCKEFELLER IV  
GOVERNOR

1900 Washington Street, East  
Charleston, West Virginia  
25305

CHARLES L. MILLER  
COMMISSIONER

October 22, 1979

Mr. Fred Orday  
Executive Vice President  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Orday:

Subject: Specifications for Zinc Rich Primer  
Your Letter Dated September 19, 1979

As per your request, enclosed is a copy of the Department's specifications for a zinc rich primer.

Should you require additional information, please feel free to contact personnel of the Materials Control, Soil and Testing Division.

The address is as follows:

Materials Control, Soil and Testing Division  
312 Michigan Avenue  
Charleston, West Virginia 25305

Telephone (304) 348-3194.

Very truly yours,

Charles L. Miller  
Commissioner

by:

Garland W. Steele  
Chief Engineer - Operations

CWS:TH

## 707.12 - COATING SYSTEM FOR CONCRETE SURFACES:

Unless otherwise indicated in the Contract, the coating described hereinafter may be used as a substitute for the specified Class 2 Rubbed Finish. The Contractor shall submit a test panel for each project in order that color and texture characteristics can be compared and controlled.

The Department may use infrared spectroscopy, gas chromatography, or other methods which are deemed necessary to assure that the quality control samples are of the same composition as the initial samples.

707.12.1 - Coating Requirements: The coating shall meet the requirements listed in Table 707.12.1.

TABLE 707.12.1

- i. Salt Spray Resistance - The coating shall show no deterioration after exposure to five percent salt spray solution for 300 hours.
- ii. Accelerated Weathering - After cycling for 500 hours the coating shall show no deterioration.
- iii. Adhesion - The coating shall provide a good bond to the concrete surface.
- iv. Freeze-Thaw - The coating shall show no deterioration after 50 cycles.

The Contractor shall conduct tests to determine adhesion of the coating to be used. Tests shall be conducted on areas of the structure as directed by the Engineer.

## 711.20 - ZINC RICH SYSTEM:

DELETE THE REQUIREMENTS LISTED IN TABLE 711.20.2 (PAGE 560).  
SUBSTITUTE THE FOLLOWING:

TABLE 711.20.2

	Minimum	Maximum
i. Coarse Particles, percent by weight -----	---	4
ii. Drying Time:		
Set-to-touch -----	---	30 min
Dry hard -----	---	1 hr

- v. Weight per Gallon - The weight per gallon of the quality control samples shall compare to the weight per gallon of the initial samples.
- vi. Compatibility - 50 cu cm of the primer shall be mixed with 50 cu cm of the manufacturer's thinner without curdling, livering, separating, or otherwise affecting the primer except to thin it.
- vii. Salt Spray Resistance - The primer shall show no deterioration after exposure to five percent salt spray solution for 21 days. Rusting in the cross scribed area shall not exceed 1/16 in. from the scribe.
- viii. Accelerated Weathering - The primer shall not be adversely affected after cycling for 300 hr.
- ix. Adhesion - Not more than 10 percent of the total cross hatches shall fail because of insufficient adhesion.
- x. Water Resistance - The primer shall show no visual deterioration other than discoloration after two days immersion in distilled water.
- xi. Color - The primer shall be formulated to produce a distinct contrast in color with the blast cleaned metal surface.

711.35 - EPOXY COATING MATERIAL - ELECTROSTATICALLY APPLIED POWDER

711.35.1 - General (Page 566):

DELETE THE SECOND PARAGRAPH. SUBSTITUTE THE FOLLOWING:

The coating materials shall be a powdered epoxy resin selected from those materials tested and approved by the National Bureau of Standards or other approved laboratories. The material shall be pretested and approved by the Department prior to use by the applicator.

711.35.2 - Material Requirements (Pages 566 and 567):

DELETE THE CONTENTS OF 711.35.2. SUBSTITUTE THE FOLLOWING:

- i. Composition: The Department may use infrared spectroscopy, gas chromatography, or other methods which are deemed

are from Federal Standard 595 and  
 .inates within five NBS units. The  
 d in the table below are intended as

ate y Coordinate Y Coordinate

.3807	48.87
.4376	04.13
.3911	20.24
.3040	22.24
.3507	65.75
.3651	16.04
.3425	48.87
.2565	17.76
.3029	23.82

ments: The material shall meet the

E 711.16.2

Minimum Maximum

.....	80	100
.....	80	100
.....	60	-
ght .....	-	10
nt by weight	-	10
.....	-	20 min
.....	-	3 hr
.....	-	24 hr
and ell) .....	No failure	-
ils dry) ....	98% C.R.	-
vehicle solids	35	-
it vinyl resin	68	-

g After cycling for 500 hr, there  
 e of checking, cracking, rusting, or  
 re of chalking shall not be more than  
 according to ASTM D 659. Color  
 shall not be more than five NBS units.  
 rem of the primer shall be able to be  
 a of the manufacturer's recommended  
 these have no separating or otherwise  
 re except to this it

711.20.2

xiii Chemical Resistance - This vinyl top coat shall show no  
 visual deterioration, other than minor discolorations,  
 after seven days' exposure to:

- 10 percent sulphuric acid solution
- 10 percent sodium hydroxide solution
- 10 percent sodium chloride solution and
- distilled water

xiv. Adhesion -- Not more than 10 percent of the total cross-  
 hatches shall fail because of insufficient adhesion

#### 711.17- VINYL SYSTEMS FOR STRUCTURAL STEEL (FIRST FIELD PRIMER):

711.17.1- General: This Specification covers a vinyl type primer  
 intended for application to steel, blast cleaned to a white or near-  
 white condition in the field. This is a rust inhibitive primer based on  
 basic lead silico chromate. All of the ingredients of this primer are  
 not specified, however, the finished product shall comply with the  
 requirements prescribed herein.

Although the requirements of this Specification leave a wide  
 latitude in the physical properties and composition to the  
 manufacturer, the quality of the material shall be such as to meet the  
 application requirements specified in other sections of the general  
 painting Specifications.

If an iron oxide pigment is used as a tinting material, it is to be a  
 commercial pure synthetic iron oxide.

711.17.2-Primer Requirements: The primer shall meet the  
 requirements listed in Table 711.15.2

#### 711.18 AND 711.19- BLANK

#### 711.20- ZINC RICH SYSTEM:

711.20.1- General: This Specification provides for an inorganic  
 zinc rich system.

Tests for intercoat compatibility of the paint system shall be  
 conducted using an approved primer, intermediate field and top  
 coat.

The Contractor shall conduct tests to determine intercoat com-  
 patibility of approved primer, intermediate and top coats to be used.  
 Tests shall be conducted on a eas of the structure as directed by  
 the Engineer.

711.20.2- Primer: The primer shall conform to the requirements  
 in Table 711.20.2



TABLE 711.20.2

	Minimum	Maximum
i. Weight per gallon (lb) .....	20	—
ii. Coarse Particles, percent by weight .....	—	4
iii. Drying Time:		
Set-to-touch .....	—	30 min
Dry through hard .....	—	1 hr
iv. Total Solids, percent by weight		
primer .....	78	—
v. Zinc Content, percent of total		
solids .....	82	—
vi. Non-Volatile Vehicle, percent of		
vehicle .....	32	—
vii. Flexibility (1/2 in. mandrel) .....	No failure	
viii. Compatibility — 50 cu cm of the primer shall be mixed with 50 cu cm of the manufacturer's thinner without curdling, livering, separating, or otherwise affecting the primer except to thin it.		
ix. Salt Spray Resistance — The primer shall show no deterioration after exposure to five percent salt spray solution for 21 days. Rusting in the gross scribed area shall not exceed 1/16 in. from the scribe.		
x. Accelerated Weathering — The primer shall not be adversely affected after cycling for 300 hr.		
xi. Adhesion — Not more than 10 percent of the total cross-hatches shall fail because of insufficient adhesion.		
xii. Water Resistance — The primer shall show no visual deterioration, other than discoloration, after two days immersion in distilled water.		
xiii. Color — The primer shall be formulated to produce a distinct contrast in color with the blast cleaned metal surface.		

711.20.3—Intermediate Field Coat: The intermediate field coat shall meet the manufacturer's specifications and shall be compatible with the primer, 711.20.2, and the top coat, 711.20.4.

711.20.4—Top Coat: The top coat shall be that recommended by the manufacturer or as specified in the Contract. The coating shall conform to the requirements in Table 711.20.4.

TABLE 711.20.4

	Minimum	Maximum
i. Drying Time		
Set-to-touch .....	—	30 min

- Dry for recoating ....
- Dry through hard ...
- ii. Flexibility (1/2 in. mandrel) .....
- iii. Compatibility — 50 cu cm mixed with 50 cu cm of thinner without curdling, livering, or otherwise affecting the coating except to thin it.
- iv. Color: The color choice shall be within five NBS units.

Federal Standard No.	x Coordinate
13523	.3842
14062	.2361
14223	.2883
15193	.2498
21667	.3512
24172	.3066
24491	.3048
25184	.2219
35273	.2878

- v. Accelerated Weathering: The primer shall be no evidence of blistering. The degree of change after 500 hr shall be within five NBS units.
- vi. Chemical Resistance: The primer shall show no visual deterioration, other than discoloration, after two days immersion in distilled water.
- a. 10 percent sulfuric acid
- b. 10 percent sodium hydroxide
- c. 10 percent sodium chloride
- d. distilled water
- vii. Adhesion: Not more than 10 percent of the total cross-hatches shall fail because of insufficient adhesion.
- viii. Salt Spray Resistance: The primer shall show no visual deterioration after exposure to five percent salt spray solution for 21 days. Rusting in the gross scribed area shall not exceed 1/16 in. from the scribe.
- ix. Dry Opacity — Minimum

Minimum	Maximum
20	—
—	4

—	30 min
—	1 hr

78

82

32

No failure  
must be mixed with  
primer without curdling,  
or affecting the primer

It shall show no deterio-  
ration after salt spray solution  
in scrubbed area shall not

It shall not be adverse  
after 1 hr

Percent of the total cross  
section of adhesion  
It shall show no visual deterio-  
ration after two days immersion

It shall produce a dis-  
tinct elemental surface  
intermetallic field coat  
and shall be compatible  
with 711.20.4

It shall be recommended by  
contract. The coating shall  
be 20.4

Minimum Maximum

30 min

- Dry for recoating ..... 3 hr  
Dry through hard ..... 24 hr
- ii. Flexibility (1/2 in. mandrel) ..... No failure
- iii. Compatibility 50 cu cm of the coating shall be able to be mixed with 50 cu cm of the manufacturer's thinner without curdling, livering, separating, or otherwise affecting the coating except to thin it.
- iv. Color The color choices permissible are from Federal Standard 595 and shall match the following coordinates within five NBS units

Federal Standard No.	x Coordinate	y Coordinate	Y Coordinate
13523	.3842	.3807	48.87
14062	.2361	.4376	04.13
14223	.2883	.3911	20.24
15193	.2498	.3040	22.24
21667	.3512	.3507	65.75
24172	.3066	.3651	16.04
24491	.3048	.3428	48.87
25184	.2219	.2568	17.76
35273	.2878	.3029	23.82

- v. Accelerated Weathering After cycling for 500 hr there shall be no evidence of checking, cracking, rusting, or blistering. The degree of chalking shall not be more than No. 6 when tested according to ASTM D 659. Color change after 500 hr shall not be more than five NBS units
- vi. Chemical Resistance The top coat shall show no visual deterioration, other than minor discolorations, after seven days' exposure to
- 10 percent sulphuric acid solution
  - 10 percent sodium hydroxide solution
  - 10 percent sodium chloride solution and
  - distilled water
- vii. Adhesion Not more than 10 percent of the total cross-hatches shall fail because of insufficient adhesion
- viii. Salt Spray Resistance The part shall show no deterioration after exposure to five percent salt spray solution for 500 hr. The rust in the cross-hatched area shall not exceed 1.15 in. from the web
- ix. Dry Density Minimum .25 GR



State of Wisconsin \ DEPARTMENT OF TRANSPORTATION



DIVISION OF HIGHWAYS AND  
TRANSPORTATION FACILITIES

4802 Sheboygan Avenue  
P. O. Box 7916  
Madison, WI 53707

October 10, 1979

Dr. Fred Ordway  
Artech Corp.  
2901 Telestar Ct.  
Falls Church, VA 22042

OCT 11 1979

Dear Dr. Ordway:

This letter is in reply to yours of September 19, 1979 regarding zinc-rich paints or primers.

Presently we do not have zinc rich paint in our standard specifications for use on steel structures. Recently we did use a zinc-rich paint system on the railing of a long bridge. The attached enclosure is a copy of the paint specifications as used on the project.

We would be interested in receiving a copy of your compilation of zinc rich paint specifications.

Sincerely,

*R. L. Musin*

R. L. Musin  
Field Materials Control Engineer

RLM:cm

Enclosure

THE STATE



OF WYOMING

Ed Herschler, Governor

Leno Menghini, Superintendent and Chief Engineer

## Wyoming State Highway Department

P. O. BOX 1708

CHEYENNE, WYOMING 82001

November 15, 1979

Mr. Fred Ordway  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Sir:

Recently you requested information in regard to specifications for zinc-rich paints or primers proposed or currently in use in this state. Wyoming State Highway Department has not utilized this type of material for structure painting and currently does not have any proposals pending for its use. The only zinc-rich paint contained in our specifications is Federal Specification MIL-P-21035 which is utilized for the repair of abraded or damaged galvanized coatings.

If I can be of further service, please contact me in the future for any additional information.

Very truly yours,

Leno Menghini, P. E.  
Superintendent and Chief Engineer

By *R. G. Warburton*  
Robert G. Warburton, P. E.  
State Materials Engineer

DEM/cs



Natural  
Resources  
Group  
WESTERN INDUSTRIES

The New Jersey Zinc Company  
1 Highland Avenue  
Bethlehem, Pennsylvania 18017  
(215) 955-9100  
TWX 510-651-4727  
September 12, 1979

Mr. Fred Ordway  
Artech Corporation  
2901 Telestar Court  
Falls Church, Virginia 22042

Dear Mr. Ordway:

In response to your recent request, enclosed  
are zinc-rich primer formulations.

If you have any questions or desire additional  
information, please let me know.

Very truly yours,

GW NATURAL RESOURCES GROUP

WALTER G. BALL  
Manager  
Technical Service

WGB:ilg  
Enclosures

Natural  
Resources  
Group  
WESTERN INDUSTRIES

WALTER G. BALL  
Manager, Technical Service  
P.O. Box 1000

S-100

The New Jersey Zinc Company  
1 Highland Avenue  
Bethlehem, Pennsylvania 18017

(215) 955-9100  
TWX 510-651-4727

THE NEW JERSEY ZINC COMPANY

10 FRONT ST. NEW YORK 38, N.Y.

# TECHNICAL INFORMATION



## STARTING FORMULATION FOR AN AIR DRYING

### ZINC-RICH EPOXY ESTER TYPE PRIMER

			Approximate Pounds Per 100 Gallons
Zinc Dust 64	(1)		2290.0
Aerosil R-972	(2)		42.0
Syloid Zn-1	(3)		4.7
Mirasol 601	(4)		225.0
Xylol			214.0
6% Co Naphthenate			1.0
5% Ca Naphthenate			2.0
Anti-Skin			.5

Wet down Aerosil with Mirasol and enough Xylol to prevent dusting, disperse thoroughly. Add zinc dusts plus Syloid Zn-1 and grind at high speed. Add remainder of Xylol and driers and mix thoroughly.

- (1) New Jersey Zinc Company
- (2) Degussa
- (3) Grace
- (4) C. J. Osborne

THE NEW JERSEY ZINC COMPANY

150 FRONT ST. NEW YORK 38, N.Y.

## TECHNICAL INFORMATION

STARTING FORMULATION FOR AN AIR DRYINGZINC-RICH EPOXY ESTER TYPE PRIMER

		Approximate Pounds Per 100 Gallons
Zinc Dust 444	(1)	2290.0
Aerosil R-972	(2)	42.0
Syloid Zn-1	(3)	4.7
Mirasol 601	(4)	225.0
Xylol		214.0
6% Co Naphthenate		1.0
5% Ca Naphthenate		2.0
Anti-Skin		.5

Wet down Aerosil with Mirasol and enough Xylol to prevent dusting, disperse thoroughly. Add zinc dusts plus Syloid Zn-1 and grind at high speed. Add remainder of Xylol and driers and mix thoroughly.

- (1) New Jersey Zinc Company
- (2) Degussa
- (3) Grace
- (4) C. J. Osborne

THE NEW JERSEY ZINC COMPANY

160 FRONT ST. NEW YORK 38, N.Y.

## TECHNICAL INFORMATION



TT-P-001046

PRIMER COATING ZINC DUST CHLORINATED RUBBER  
(FOR STEEL AND GALVANIZED SURFACES)

SCOPE: This specification covers a ready-mixed zinc dust, chlorinated rubber-primer coating for use on steel and galvanized metal.

Disperse in Cowles or Hockmeyer. Dissolve the following:

	<u>lbs. per 100 gallons</u>
(1) Bentone 38	10
(2) Syloid ZN-1	10
Xylol	100

Disperse well and add Denatured Alcohol.

Runn for 5 minutes and add

(3) Solvesso 100	245
(4) Parlon S-20	113
(5) Arochlor 5460	14
(6) Arochlor 1254	23

Disperse well and add

(7) Epichlorhydrin	5
Xylol	75
(8) Zinc Dust 422	1550

Zinc Dust dry film 91.00%

Zinc Dust wet film 72.0%

- (1) National Lead
- (2) Davison Chemical Company
- (3) Humble Oil
- (4) Hercules
- (5) Monsanto Chemical
- (6) Monsanto Chemical
- (7) Shell Chemical Company
- (8) New Jersey Zinc Company

S - 100

September 7, 1967



ZINC RICH COATING BASED ON OIL MODIFIED URETHANE

	<u>lbs./100 GALS.</u>
1. Cargill 1210X	321.0
Xylol	152.0
2. Aerosil R-972	43.0

Mix Aerosil R-972 with Xylol and Cargill 1210X in dissolver at high speed. When dispersed well, add:

24% Pb Napthenate	2.7
6% Co "	1.3
4% Ca "	1.3
ASA	0.8
NJZ Zinc Dust 422	2138.0

N.V.% by Weight	89.2
Pigment/Binder	11/1

Thin with Xylol to satisfactory brush or spray consistency.

1. Cargill Co., Minneapolis, Minn.
2. Degussa, Inc., Kearney, N.J.

CATALYZED EPOXY ZINC RICH PRIMER

<u>PART A</u>	<u>POUNDS/100 gals.</u>
Zinc Dust #422	2682.0
Bentone 38(1)	24.0
Syloid Zn-1(2)	24.0
 <u>PART B</u>	
Soya Lecithin	3.6
Epi-Rez 285(3)	238.2
Xylol	65.4
Diacetone Alcohol	36.0
Butyl Cellosolve	79.8
 <u>PART C</u>	
Versamide -125(4)	94.2
Butyl Cellosolve	82.8

Add Part A to Part B just prior to addition of Part C.

Thin to spray consistency with Butyl Cellosolve.

- (1) National Lead Company
- (2) Davison Chemical Company
- (3) Celanese Coatings Company
- (4) General Mills, Inc.

THE NEW JERSEY ZINC COMPANY

160 FRONT ST. NEW YORK 38, N.Y.

## TECHNICAL INFORMATION



## ZINC DUST PAINT

LINSEED OIL VEHICLE-- FED.SPEC. TT-P-641d TYPE I
FORMULA P-0171-ZE
Pigment....78%

	<u>Pounds</u>	<u>Gallons</u>
STANDARD ZINC DUST-22.....	1,473	25.15
HORSE HEAD XX Zinc Oxide (1).....	368	7.88

Vehicle....22%

Linseed oil (raw) (2).....	468	60.25
Mineral spirits .....	37	5.70
Lead-manganese oil drier (3).....	24	3.25
	<u>2,360</u>	<u>102.33</u>

Pounds per gallon....23.5

P.V.C. ....35%

Volatile in vehicle..10%

Color..... blue-gray

REMARKS:

- (1) XX-503, XX-601, or XX-602
- (2) Pure, moisture-free and low acidity (less than 4)
- (3) Complies with Fed. Spec. TT-D-651, Type I

To meet Federal Specification TT-P-641D, Type I the following procedure should be followed: Mix and grind the zinc oxide with sufficient of the oil to form a smooth paste. Reduce this paste with the remainder of the oil, the mineral spirits and the liquid drier. This produces a thin "zinc oxide paint" ready for packaging. The zinc dust is packaged in a separate container. Since 8.87 pounds of the "zinc dust paint" and 14.73 pounds zinc dust produce one gallon of paint, the two containers should contain the same multiple of these quantities. Since Government specifications are revised from time to time, the paint manufacturer when using this formula should assure himself that it is current. He should also test his paint for all requirements covered in the specification.

THE NEW JERSEY ZINC COMPANY

160 FRONT ST. NEW YORK 38, N.Y.

## TECHNICAL INFORMATION



ZINC DUST PAINT  
ALKYD VEHICLE--FED. SPEC. TT-P-641d, TYPE II

FORMULA P-2417-ZE

<u>Pigment - 65%</u>	<u>Pounds</u>	<u>Gallons</u>
Standard Zinc Dust-22 .....	889	15.2
Horse Head XX Zinc Oxide (1) ..	222	4.8
<u>Vehicle - 35%</u>		
Alkyd Resin (2) .....	377	47.2
Mineral Spirits .....	213	32.0
Lead Drier (24% Pb) .....	6	0.6
Cobalt Drier (6% Co) .....	1	0.1
Manganese Drier (6% Mn) .....	1	0.1
	1709	100.0

Pounds Per Gallon - 17.1  
P.V.C. - 40%  
Volatile in Vehicle - 55.2%

REMARKS:

- (1) XX-503, XX-601, or XX-602  
(2) TT-R-266 Type II Class A

The paint ingredients shall be furnished in two separate containers, one containing a paint consisting of the zinc oxide and vehicle and the other the dry zinc dust which is to be added to the zinc oxide paint just prior to use. The zinc dust should be added a little at a time to the zinc oxide paint, stirring thoroughly after each addition.

To prepare the zinc oxide paint, mix the zinc oxide with enough alkyd resin to obtain a paste of good milling consistency. Grind on roller or high-speed mill. Reduce paste with balance of vehicle.

Since Government specifications may be revised from time to time, the paint manufacturer should assure himself that the above specification is still current. Also, for Government use, he should test his paint for all requirements set up in the specification.

THE NEW JERSEY ZINC COMPANY

160 FRONT ST. NEW YORK 38, N.Y.

## TECHNICAL INFORMATION



## ZINC DUST PAINT

Phenolic-Resin-Vehicle--Fed. Spec. TT-P-641d, Type III
FORMULA P-0463-ZE
Pigment....65%

	<u>Pounds</u>	<u>Gallons</u>
STANDARD Zinc Dust-22 .....	897	15.30
HORSE HEAD XX Zinc Oxide (1) .....	224	4.80

Vehicle....35%

Varnish V-628 (2) .....	526	68.00
Mineral spirits .....	72	11.00
Lead drier (24% Pb).....	5	0.50
Cobalt drier (6% Co).....	2	0.25
Manganese drier (6% Mn).....	1	0.12
	1725	99.97

Pounds per gallon ..... 17.25

P.V.C. .... 35.4%

Volatile in vehicle ... 52%

## Remarks:

(1) XX-600 - XX-601 - XX-602

(2) Known as Bak-lite VF 628 60% solids

Mix and grind the zinc oxide with enough Varnish V-628 to obtain a paste of good milling consistency on a Hi Speed Dispenser or steel roller mill, and thin with the remainder of the vehicle.

It is suggested that separate containers be used, the zinc oxide going into one container, and the dry zinc dust in a separate container. To make the complete paint before use, the zinc dust should be added last, or a time to the zinc oxide going, stirring thoroughly after each addition.

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Apr 14, 1963

THE NEW JERSEY ZINC COMPANY

160 FRONT ST. NEW YORK 39, N.Y.

# TECHNICAL INFORMATION



## ZINC DUST PAINT

For Interior of Fresh Water Tanks  
Military Spec. MIL-15145B - Navy Formula No. 102

PIGMENT - 69%	Pounds	Gallons
STANDARD Zinc Dust-222 .....	934	15.88
HORSE HEAD XX Zinc Oxide (1) ...	234	5.03
Aluminum Stearate .....	23	2.76
VEHICLE - 31%		
Varnish (2) .....	229.0	29.79
Mineral Spirits .....	300.0	45.96
Cobalt Drier (6% Co) .....	2.3	0.29
Manganese Drier (6% Mn) .....	2.3	0.29
	1724.6	100.00
Pounds Per Gallon	- 17.2	
Non-Volatile in Vehicle	- 25.8%	

### REMARKS:

(1) Such as XX-2, -50, -55, -503, -600, etc.

(2) Phenolic resin, linseed, tung, 25-gallon-length varnish. Should conform to Military Spec. MIL-V-15218A, Type II.

The zinc oxide-base paint is made by grinding the zinc oxide in V-402 (about 80% pigment, 20% vehicle) and thinning this paste with the balance of the vehicle.

The zinc dust and the zinc oxide-base paint should be shipped in two separate containers. The Navy requires that 5 1/2 pounds of dry zinc dust be put in one container (2 1/2 to 3-gallon steel pail) and 5 gallons zinc oxide-base paint in a second container. The zinc dust and the zinc oxide-base paint should be mixed just prior to use.

### Mixing Instructions

To one gallon of zinc oxide-base paint add the dry, sieved zinc dust in increments of 2 1/2 to 5 pounds and mix with a paddle until free from lumps and until no dry particles of zinc dust are noted when a dash of the paste is made on glass by means of a spatula.

If the paste becomes too heavy for good mixing before all the zinc dust is added, all enough extra zinc oxide base paint to make a paste of good mixing properties.

After all the zinc dust is added, the mixture should be stirred for 15 minutes. The mixture should be used within 24 hours.

**DATA  
FILM**